

Alibaba Cloud

云原生关系型数据库PolarDB O引擎

Product Introduction

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Document conventions




Style	Description	Example
 Danger	A danger notice indicates a situation that will cause major system changes, faults, physical injuries, and other adverse results.	 Danger: Resetting will result in the loss of user configuration data.
 Warning	A warning notice indicates a situation that may cause major system changes, faults, physical injuries, and other adverse results.	 Warning: Restarting will cause business interruption. About 10 minutes are required to restart an instance.
 Notice	A caution notice indicates warning information, supplementary instructions, and other content that the user must understand.	 Notice: If the weight is set to 0, the server no longer receives new requests.
 Note	A note indicates supplemental instructions, best practices, tips, and other content.	 Note: You can use Ctrl + A to select all files.
>	Closing angle brackets are used to indicate a multi-level menu cascade.	Click Settings> Network> Set network type .
Bold	Bold formatting is used for buttons, menus, page names, and other UI elements.	Click OK .
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>

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1.What is ?

is a new-generation that is developed by Alibaba Group. This service decouples computing from storage and uses integrated software and hardware. PolarDB is a secure and reliable database service that provides auto scaling, high performance, and mass storage. PolarDB is fully compatible with MySQL 5.6, MySQL 5.7, MySQL 8.0, and PostgreSQL 11. PolarDB is highly compatible with Oracle.

uses an architecture that decouples computing from storage. All compute nodes share one set of data. PolarDB allows you to upgrade or downgrade specifications within minutes, and supports disaster recovery within seconds. PolarDB ensures that global data is consistent and offers data backup and disaster recovery for free. provides the benefits of both commercial databases and open source cloud databases. The benefits of commercial databases include stability, reliability, high performance, and scalability. The benefits of open source cloud databases include ease of use, openness, and self iteration.

- Computing and storage are decoupled. A distributed storage system is shared by all compute nodes.

PolarDB for Oracle decouples computing and storage. This way, you can use auto scaling to meet the requirements of your business. All compute nodes share the same underlying storage PolarStore by using the distributed file system PolarFileSystem. This reduces a large amount of storage costs.

- Each cluster consists of one primary node and multiple read-only nodes. This allows PolarDB to provide read/write splitting.

uses multi-node clusters to provide services. Each PolarDB cluster consists of one primary node and at least one read-only node. You can perform read and write operations on the primary node. uses PolarProxy to provide external services for the applications that are connected to cluster endpoints. PolarProxy forwards the requests from the applications to database nodes. You can use the proxy to perform authentication, data protection, and automatic read/write splitting. The proxy parses SQL statements, sends write requests to the primary node, and evenly distributes read requests to multiple read-only nodes. The proxy allows applications to access PolarDB for Oracle by using the same method that is used to access a single-node database.

Benefits

You can use in the same way as you use Oracle. Compared with traditional databases, has the following advantages:

- **Large storage capacity**

The maximum storage capacity of a cluster is 100 TB. You do not need to purchase instances for database sharding due to the storage limit of a single host. This simplifies application development and reduces the O&M workload.

- **Low costs**

- Shared storage: PolarDB for Oracle decouples computing and storage. You are charged only for the computing resources when you add read-only nodes to a PolarDB for Oracle cluster. In traditional database solutions, you are charged for both computing and storage resources when you add read-only nodes.
- Elastic storage: You do not need to specify the storage capacity. The storage capacity is automatically scaled based on the data volume. You are charged on an hourly basis only for the storage that you use.

- **Storage plan:** provides storage plans that are billed based on the subscription billing method. We recommend that you use storage plans to offset the cost of large amounts of data. No discounts are available for storage that is paid for on an hourly basis. The subscription billing method of storage plans offers discounts. Larger discounts are provided for larger storage plans.

- **High performance**

PolarDB for Oracle improves online transaction processing (OLTP) performance and supports more than 500,000 read requests per second and more than 150,000 write requests per second.

- **Elastic scaling within minutes**

PolarDB supports rapid scaling for computing. This is based on container virtualization, shared distributed storage, and compute-storage separation. It requires only 5 minutes to add or remove a node. The storage capability is automatically scaled up. During the scale-up process, your services are not interrupted.

- **Read consistency**

PolarDB uses log sequence numbers (LSNs) for cluster endpoints that have read/write splitting enabled. This ensures global consistency for read operations and prevents the inconsistency that is caused by the replication delay between the primary node and read-only nodes.

- **Millisecond-level latency in physical replication**

PolarDB performs physical replication from the primary node to read-only nodes based on redo logs. The physical replication replaces the logical replication that is based on binary logs. This way, the replication efficiency and stability are improved. No delays occur even if you perform DDL operations on a large table, such as adding indexes or fields.

- **Data backup within seconds**

No more than 30 seconds are required to perform a full backup on a database regardless of the data volume of the database. During the backup, the database is not locked. This minimizes the impact of data backup on your applications. You can specify a point in time to back up the database data based on your business requirements.

- **Parallel execution**

PolarDB for Oracle provides the cross-node parallel execution feature. After you enable this feature, an SQL statement can be executed on multiple nodes in parallel. This way, you can make full use of the hardware resources of all compute nodes, such as CPUs, memory, and network resources. This improves the performance of analytical queries. For more information, see [Cross-node parallel execution](#).

Pricing

For more information, see [Billable items](#) and visit the [buy page of PolarDB clusters](#).

Use the service

You can use the following methods to manage clusters. Cluster management includes creating clusters, databases, and accounts.

- **Console:** PolarDB provides a visualized web interface. This simplifies management operations.
- **CLI:** You can use Alibaba Cloud CLI to perform all the operations that are available in the console.
- **SDK:** You can use PolarDB for Oracle SDK to perform the same operations that you can perform in the console.

- **API**: You can call API operations to perform all the operations that are available in the console.

After a cluster is created, you can connect to the cluster by using the following methods:

- **DMS**: You can connect to a PolarDB cluster by using Data Management System (DMS) and develop databases on the web interface of DMS. For more information, see [Use DMS to connect to a cluster](#).
- **Client**: You can use common database clients such as pgAdmin to connect to clusters.

Terms

Before you purchase and use , we recommend that you familiarize yourself with the following terms:

- **Cluster**: A cluster consists of a primary node and a maximum of 15 read-only nodes. PolarDB for Oracle uses a cluster architecture.
- **Region**: A region is a geographic area where a data center is deployed. In most cases, clusters must be deployed in the same region as ECS instances to ensure optimal access performance.
- **Zone**: A zone is a geographic area in a region. Each zone has an independent power supply and network. All zones in a region provide the same services.
- **Specification**: A specification specifies the resources on a node. For example, the specification of a node can be 2 CPU cores and 8 GB memory.

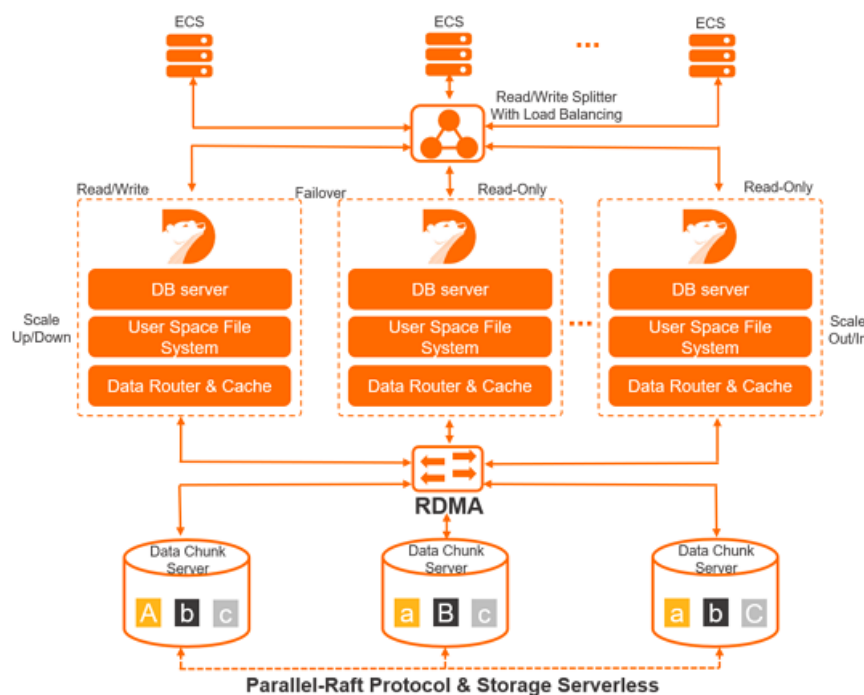
Related services

- **ECS**: ECS instances serve as cloud servers. If you connect to a cluster from an ECS instance that is deployed in the same region as the PolarDB cluster over an internal network, the cluster provides optimal performance. In a typical service architecture, ECS instances are used in combination with clusters.
- **ApsaraDB for Redis**: ApsaraDB for Redis is a database service that supports in-memory storage and persistent storage. In scenarios in which large numbers of access requests exist, you can use ECS, , and ApsaraDB for Redis to improve the read IOPS and reduce the response time.
- **ApsaraDB for MongoDB**: ApsaraDB for MongoDB is a stable, reliable, and scalable database service that is fully compatible with MongoDB protocols. You can store structured data in and unstructured data in ApsaraDB for MongoDB to meet your various business requirements.
- **Data Transmission Service (DTS)**: You can use DTS to migrate on-premises databases to clusters.
- **OSS**: Object Storage Service (OSS) is a secure, cost-effective, and reliable cloud storage service that allows you to store a large amount of data.

2. Architecture

is based on the cloud native architecture. provides the benefits of commercial databases and open source cloud databases. Commercial databases offer the benefits of stability, reliability, high performance, and scalability. Open source cloud databases offer the benefits of simplicity, openness, and rapid iteration. This topic describes the architecture and features of .

Product architecture



One primary node and multiple read-only nodes

uses a distributed cluster-based architecture. A cluster consists of a primary node and a maximum of 15 read-only nodes. At least one read-only node is used to ensure high availability. The primary node processes read and write requests and the read-only nodes process only read requests. uses the active-active failover method between the primary node and read-only nodes. This method provides the high availability service of databases.

Compute and storage decoupling

decouples compute from storage. This allows you to scale clusters that are deployed on Alibaba Cloud based on your business development requirements. The database compute nodes (database engine servers) store only metadata. The remote storage nodes (database storage servers) store data, such as data files and redo logs. You need only to synchronize the metadata that is related to redo logs among your compute nodes. This reduces the replication delay between the primary node and read-only nodes. If the primary node is faulty, a read-only node can serve as the primary node in a short period.

Read/write splitting

By default, read/write splitting is a transparent, high availability, and adaptive load balancing capability that is provided for free. The read/write splitting feature automatically forwards Structured Query Language (SQL) requests to each node of based on cluster endpoints. This allows you to process concurrent SQL statements in aggregation and high-throughput scenarios. For more information, see [Read/write splitting](#).

High-speed network connections

High-speed network connections are used between compute nodes and storage nodes of databases. The Remote Direct Memory Access (RDMA) protocol is used to transmit data between compute nodes and storage nodes. These two features eliminate the bottlenecks of I/O performance.

Shared distributed storage

Multiple compute nodes share one set of data. Each compute node does not need to store the same set of data. This significantly reduces your storage costs. The storage capacity can be smoothly scaled online by using the new developed distributed storage and distributed file system. This feature is not limited by the storage capacity of a single database server and can cope with hundreds of terabytes of data.

Multiple data replicas and the Parallel-Raft protocol

The data on storage nodes of databases has multiple replicas. This ensures data reliability. In addition, the Parallel-Raft protocol is used to ensure data consistency among these replicas.

3. Benefits

This topic describes the benefits of .

Ease of use

is highly compatible with the Oracle syntax. If you want to migrate your services from Oracle databases to , you do not need to modify your code or applications or need only to make a few minor modifications.

Cost efficiency

- Separation of computing and storage: Compute nodes share storage resources. You only pay for compute nodes when you add read-only nodes, which greatly reduces scale-out costs.
- Serverless storage: You do not need to manually configure storage space, because the storage space is automatically scaled based on the data volume. You only need to pay for the database capacity that you have used.

High performance

- With an improved database kernel, supports physical replication, RDMA protocol, and shared distributed storage, which greatly improves performance.
- An cluster contains one primary node and up to 15 read-only nodes. The cluster meets performance requirements in high concurrency scenarios, particularly suitable for scenarios where read requests are far more than write requests.
- An cluster shares storage among the primary node and read-only nodes. To apply data changes to nodes in the cluster, you only need to change data once.

Storage capacity for hundreds of terabytes of data

uses distributed block storage and a file system to allow automatic scale-up of database storage capacity, regardless of the storage capacity of each node. This enables your database to handle up to hundreds of terabytes of data.

High availability, reliability, and data security

- Supports shared distributed storage to eliminate data inconsistency in the secondary database caused by asynchronous primary-secondary replication. This ensures zero data loss if a single point of failure occurs in a database cluster.
- Supports a multi-zone architecture. Data replicas are available across multiple zones for database disaster recovery and backup.
- Provides various security measures for your database access, storage, and management. These measures include setting an IP whitelist for database access, using VPC for network isolation, and creating multiple replicas for data storage.

Rapid elastic scaling to handle workload spikes

- Configuration upgraded or downgraded within 5 minutes
supports rapid CPU and memory expansion by using container virtualization and shared distributed block storage.
- Nodes added or removed within 5 minutes

can dynamically add or remove nodes to help you improve performance and reduce costs. You can use cluster endpoints to mask changes at the underlying layer. In this case, applications are unaware of the addition or removal of nodes.

Lock-free backup

Based on the snapshot technology of underlying distributed storage, requires only a few minutes to back up a database with TB-level data. During the entire backup process, no lock is required, which delivers higher efficiency and minimizes the negative impact.

Cross-node parallel execution

supports the cross-node parallel execution feature. After you enable this feature, an SQL query can be run on multiple nodes in parallel. This way, you can fully take advantage of the hardware resources of all the compute nodes, such as CPUs, memory, and network resources. This improves **the performance of analytical queries**. For more information, see [Cross-node parallel execution](#).

4. Cross-node parallel execution

provides the cross-node parallel execution feature. If this feature is enabled, an SQL query can be run on multiple compute nodes in a distributed manner. This improves the query performance of , increases the I/O throughput of Polar File System (PolarFS) and the CPU utilization of the compute nodes, and improves the memory usage of the compute nodes.

The cross-node parallel execution feature provides the following benefits:

- Some hybrid transaction/analytical processing (HTAP) capabilities:
 - Analytical queries on transaction processing (TP) data can be run in real time.
 - The read-only nodes on which analytical queries are run are physically isolated from the read-only nodes on which transactional queries are run. This eliminates the impact on TP services.
- Elastic scaling enabled by the compute-storage separation architecture of :
 - Read-only nodes can be added based on your business requirements to increase computing resources. The added nodes are automatically included in the list of read-only nodes on which parallel execution is performed in a distributed manner. This way, the system does not need to perform resharding on data.
 - No data skew occurs.

For more information about cross-node parallel execution, see [Cross-node parallel execution](#).

5.Limits

This topic describes the limits of Apsara .

Node type	Maximum number of files
polar.o.x4.medium	1048576
polar.o.x4.large	2097152
polar.o.x4.xlarge	2097152
polar.o.x8.xlarge	4194304
polar.o.x8.2xlarge	8388608
polar.o.x8.4xlarge	12582912
polar.o.x8.12xlarge	20971520

Maximum number of files: includes user table files, database system table files (approximately 1,000), and log files. An Apsara PolarDB table (non-partition table) occupies three files: data file, visibility map file, and FSM file. Each index indicates a file if indexes are used. The following error message appears when you create a table after the maximum number of files is reached:

```
could not create file
```

In this case, you need to delete some tables or upgrade the specifications of your cluster.

Other limits

Item	Limit
Root privilege of databases	does not support the superuser privilege. Instead, it supports the polar_superuser privilege as a subset of the superuser privilege.