



# Database Services



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# Foreword

- After learning basic compute, storage, and networking services on Huawei Cloud, let's move on to database services.



# Objectives

- After completing this lesson, you will be able to understand:
  - Basic database concepts
  - Characteristics of Huawei Cloud relational and non-relational database services
  - Differences between relational and non-relational databases
  - How to use database services to set up a service architecture
  - How to use Data Admin Service (DAS)



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- 1. Introduction to Database Services**
2. Relational Database Services
3. Non-Relational Database Services
4. Data Admin Service (DAS)

# **Besides OBS, EVS, and SFS, are there any other services that can be used to store data?**



Object Storage Service  
OBS

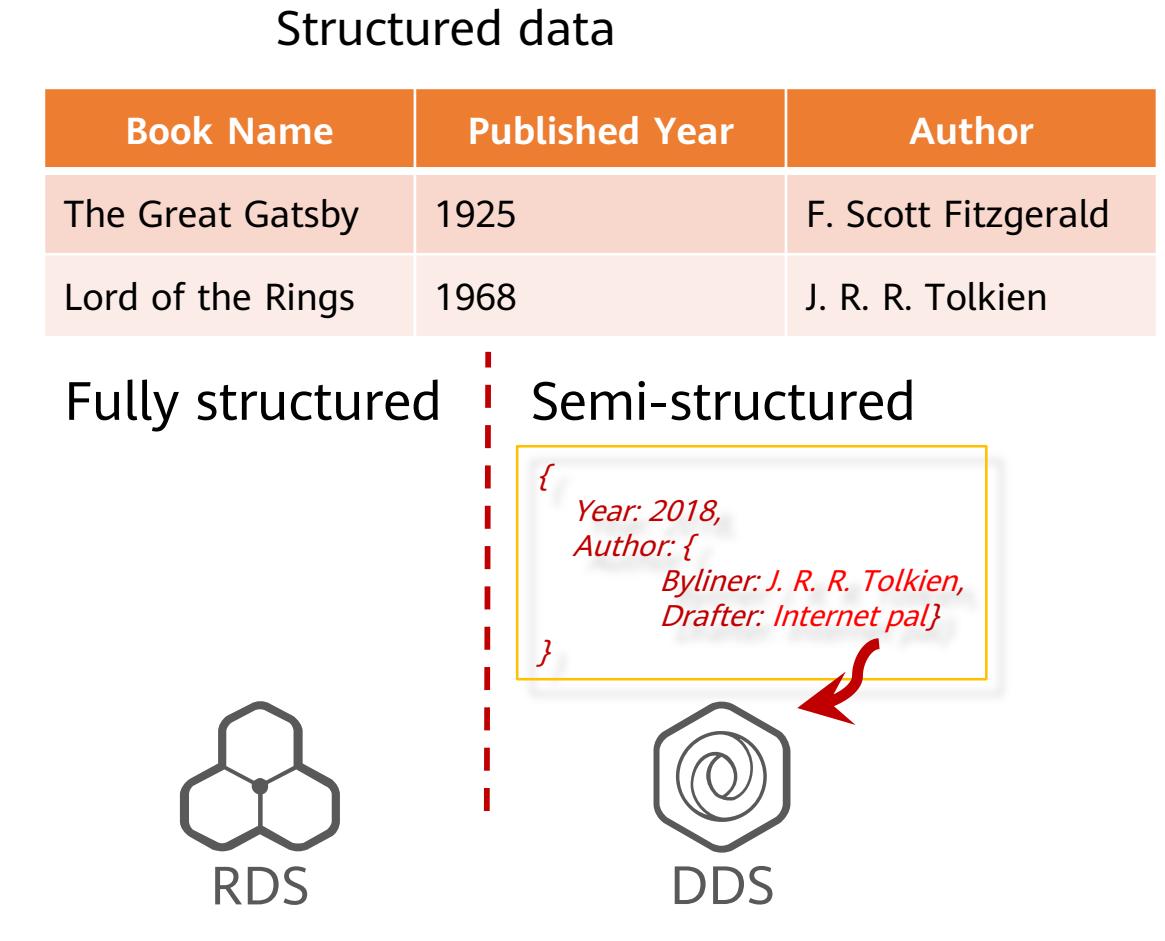
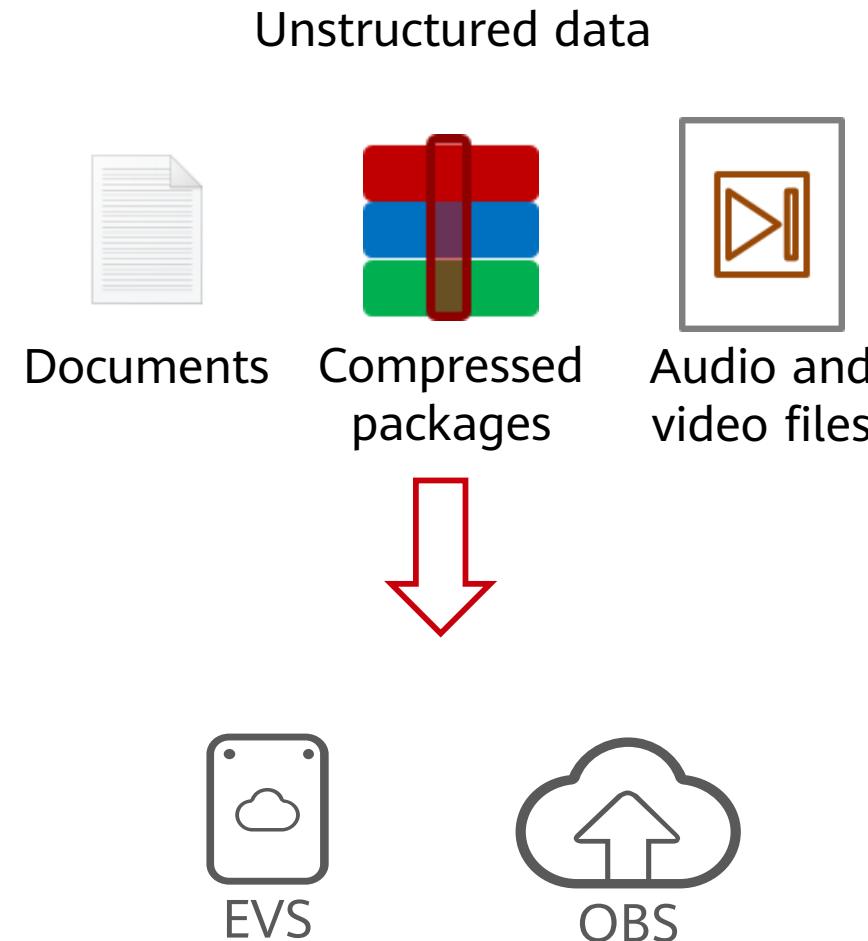


Elastic Volume Service  
EVS



Scalable File Service  
SFS

# Different Data Types



# Relational Database vs Non-Relational Database

	Relational Database	Non-Relational Database
<b>Application model</b>	Traditional applications require databases that can process transactions, complex queries, and joint queries, and maintain data integrity.	New Internet applications require databases that can store massive data and handle a large number of concurrent requests.
<b>Access performance</b>	10 ms-level Depending on query complexity and the amount of stored data	ms-level Irrelevant to the amount of stored data
<b>Data types</b>	Fully structured	Semi-structured (key-value pairs and documents)
<b>Scalability</b>	Vertical scaling Horizontal scaling: primary instance + read replicas	Vertical scaling Horizontal scaling: cluster + read replicas
<b>Data consistency</b>	Strong consistency	Depending on database configurations Strong consistency or eventual consistency
<b>Storage space limit</b>	Depending on the DB engine	Depending on the upper limit of DB nodes in different scaling modes

# Diversified Huawei Cloud Databases



## Relational

For traditional database workloads



RDS



GaussDB



RDS for MySQL



TaurusDB



RDS for PostgreSQL



GaussDB



RDS for MariaDB



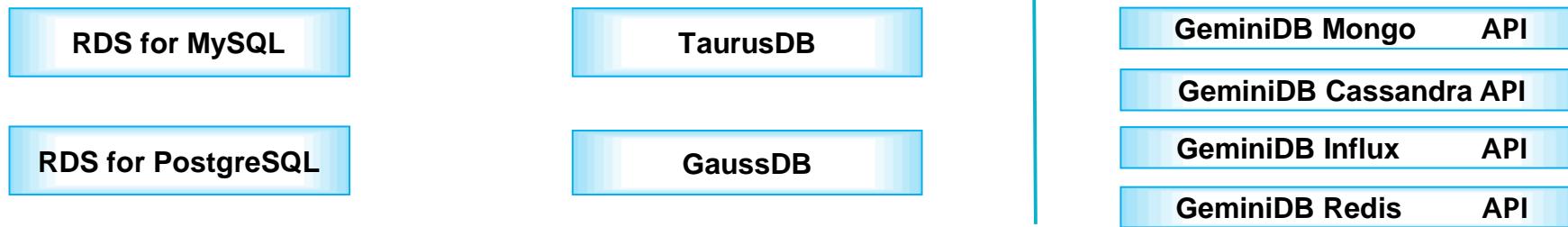
RDS for SQL Server

## Non-Relational

For fast-growing workloads



GeminiDB



DDS

Database ecosystem  
Building complete database solutions



DRS



DAS



DBSS



UGO

# Advantages of Cloud Native

Database optimization
Database development
Backup and restoration
High availability
Database engine management
Patch and configuration management
Software system
OS
Physical device maintenance
Power supply, cooling, and cabinets
Buildings, locations

Traditional DC deployment

Database optimization
Database development
Backup and restoration
High availability
Database engine management
Patch and configuration management
Software system
OS
Physical device maintenance
Power supply, cooling, and cabinets
Buildings, locations

Deployed on cloud servers

Legend:

Green: Huawei Cloud's responsibilities

Blue: Customer's responsibilities

Database optimization
Database development
Backup and restoration
High availability
Database engine management
Patch and configuration management
Software system
OS
Physical device maintenance
Power supply, cooling, and cabinets
Buildings, locations

Cloud native



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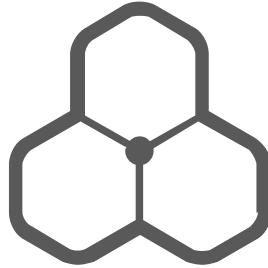
1. Introduction to Database Services

## 2. Relational Database Services

3. Non-Relational Database Services

4. Data Admin Service (DAS)

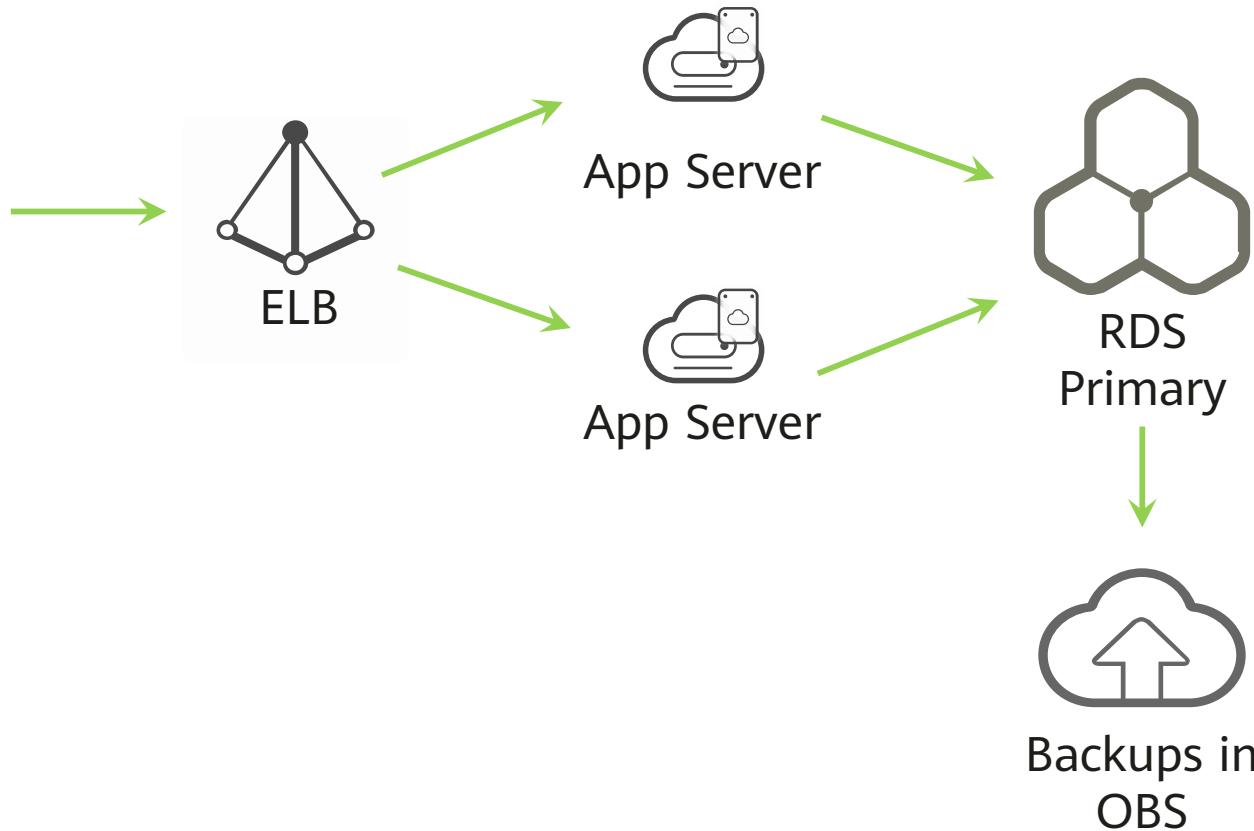
# Relational Database Service (RDS)



RDS

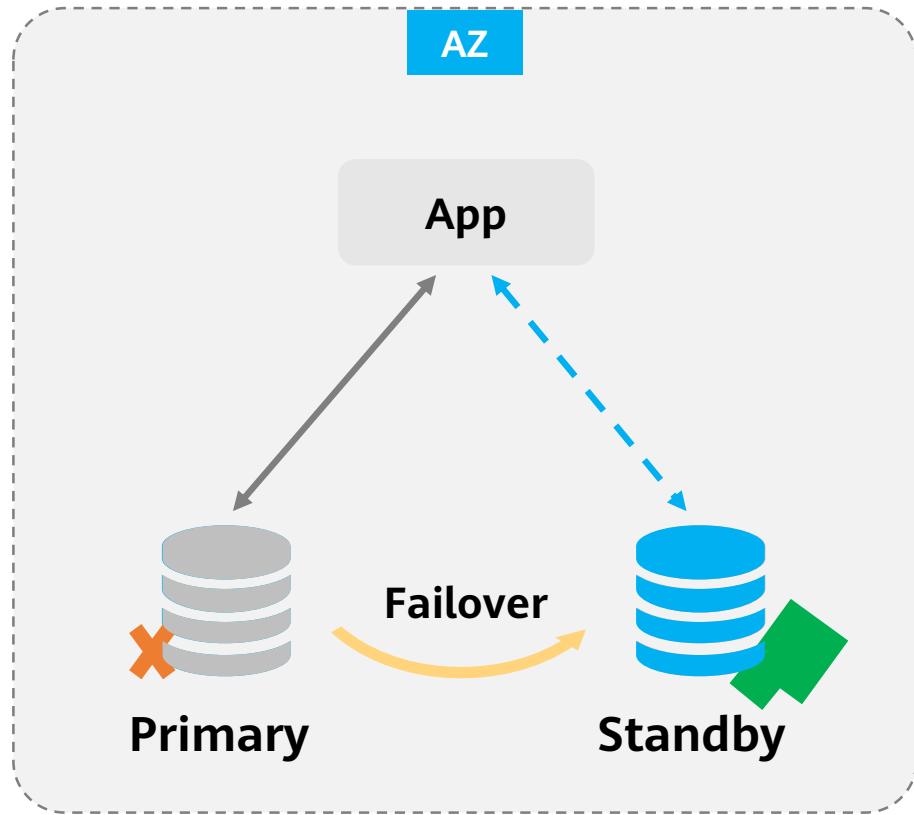
- A service that manages database engines and resources
- Compatible with mainstream relational database engines  
MySQL, PostgreSQL, SQL Server
- A cloud-native service that is easy to maintain
- Built-in automated backup and patching
- HA configuration and automatic switchover/failover within seconds
- Multiple read replicas supported

# Building a Simplified Architecture

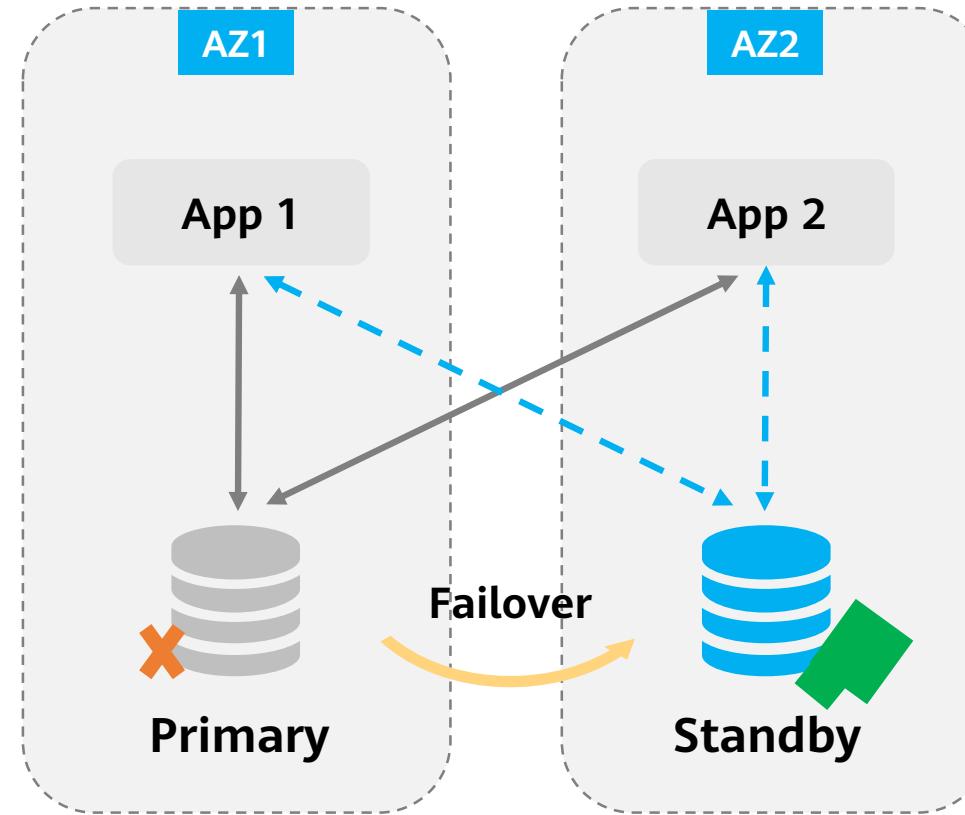


- A database service, for example, RDS functions as a database resource manager.
- Applications access the database using IP addresses, the same way as before.
- DB engines and versions are selected while you are creating databases.
- However, this architecture has service availability issues.

# High Availability of RDS

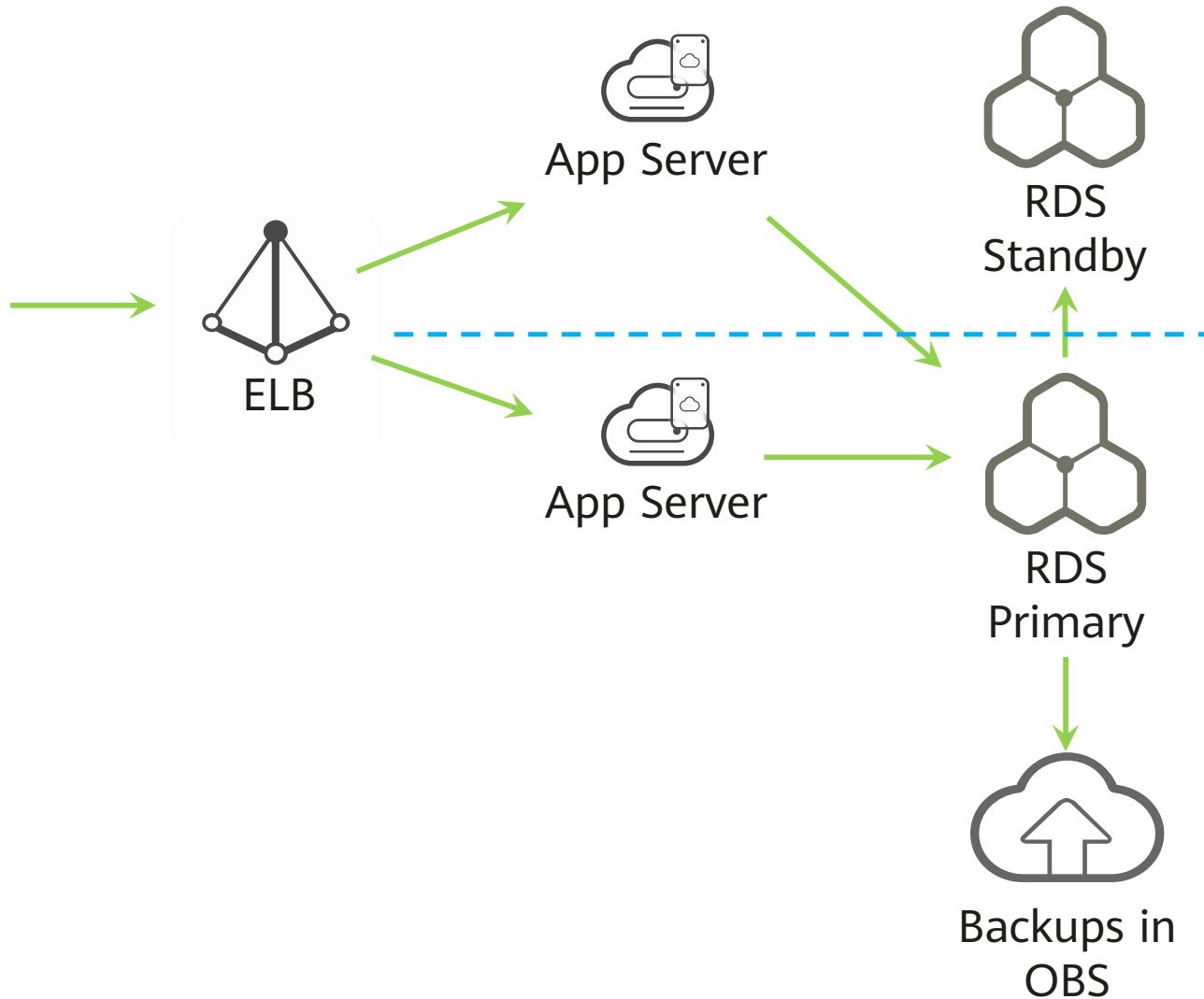


Primary/standby deployment within an AZ



Primary/standby deployment across AZs

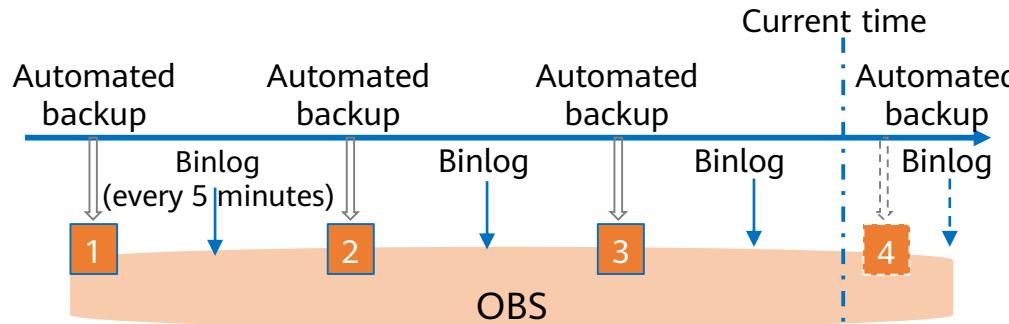
# Building an HA Architecture



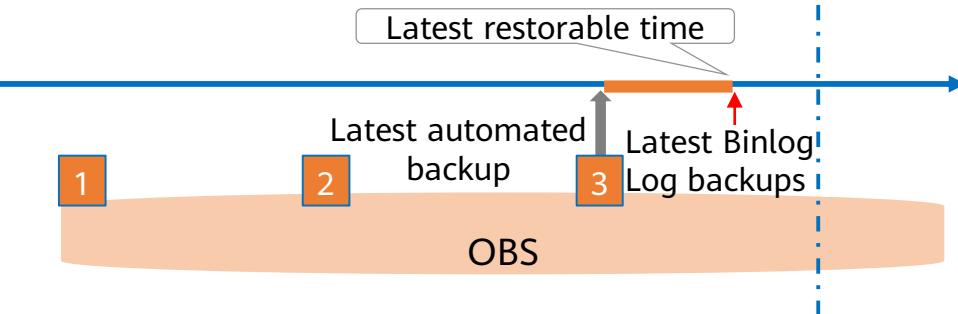
- Databases are deployed in different AZs to ensure high availability.
- DB engines ensure failover within seconds.
- Using primary/standby deployment can avoid service interruptions during maintenance.
- If the primary instance fails, workloads can be smoothly switched over to the standby instance.

# Backup Characteristics of RDS

## Full data backup + Binlog backup



## PITR



Backups are stored in OBS and can be restored to the customer's on-premises data center.

01

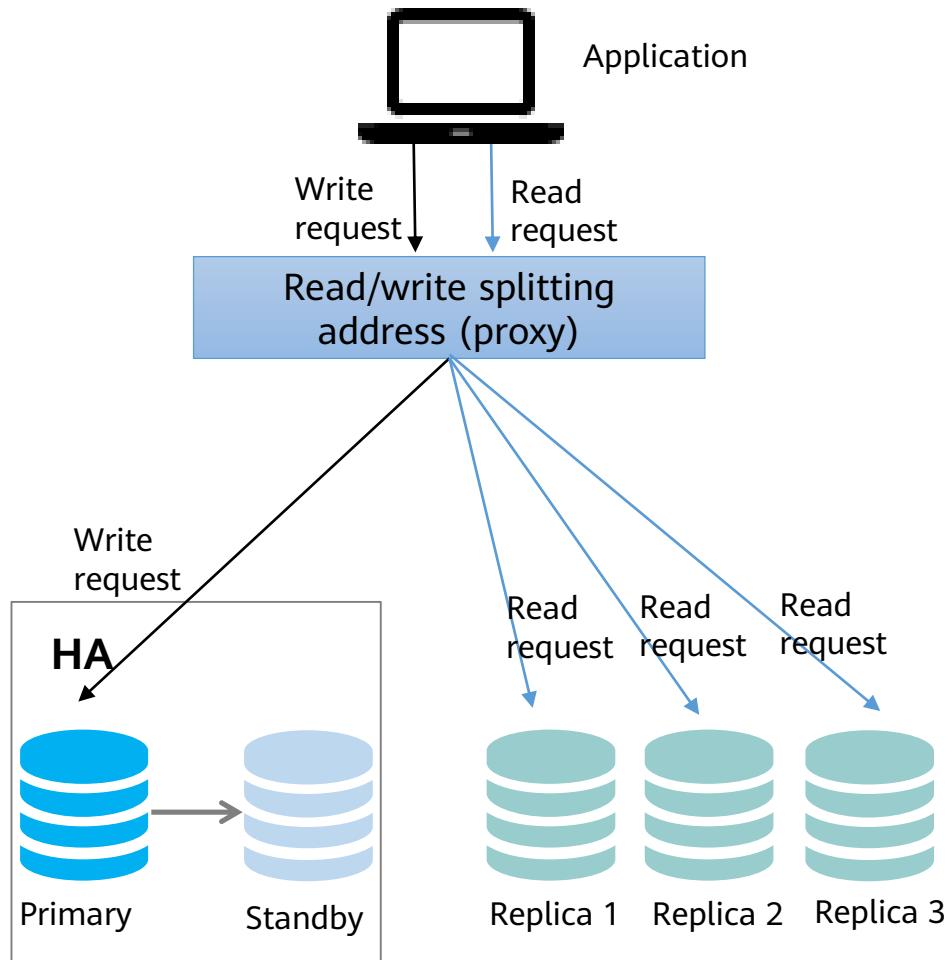
Automated binlog backup and manual backup are supported.

02

Binlog backups can be restored to a specific point in time.

03

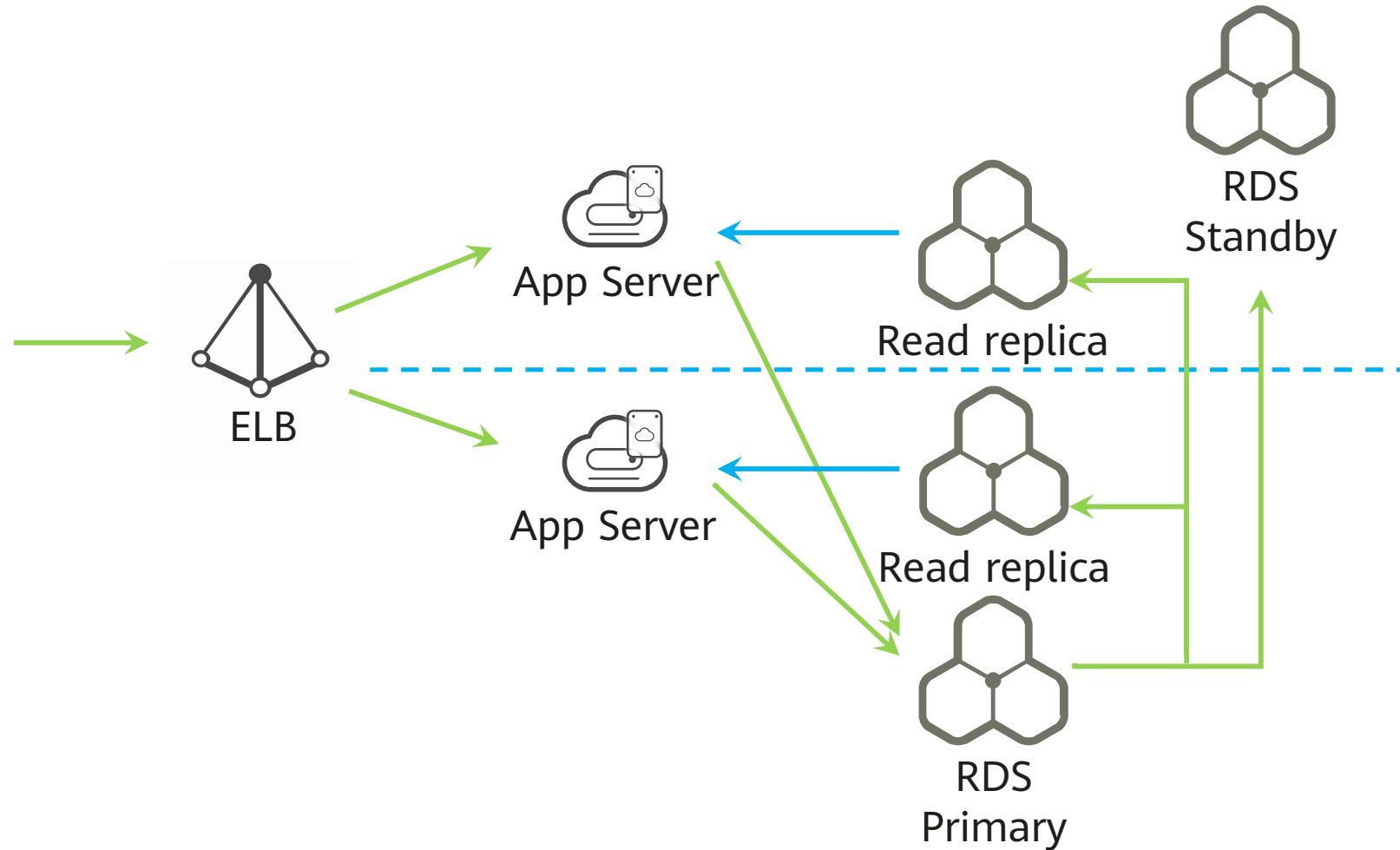
# RDS Read/Write Splitting



## Basic functions

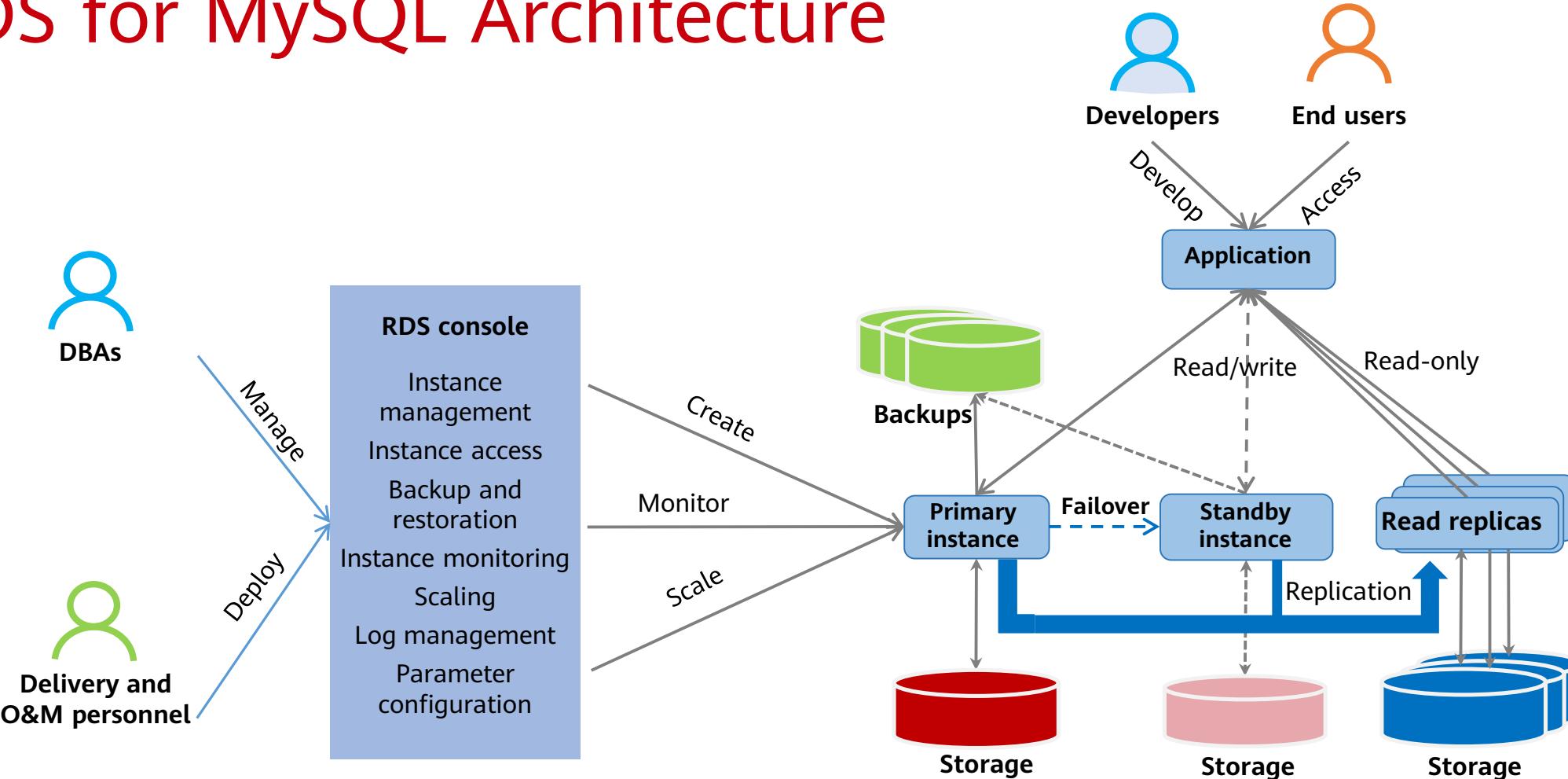
- A unified read/write splitting address is provided, transparent to applications.
- Read weights are configurable for each node.
- If a health check detects that a read replica fails or the I/O latency of a read replica goes beyond your preset threshold, read requests are no longer distributed to the read replica.

# Scaling Out Using Read Replicas

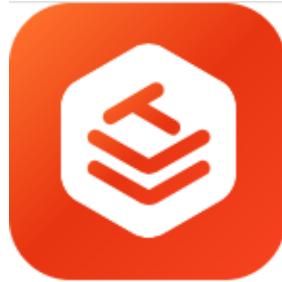


- Read replicas can be added or deleted as needed.
- The number of read replicas supported per DB instance varies by DB engine type. A DB instance supports up to 10 read replicas.
- Data can be replicated across AZs within a given region.

# RDS for MySQL Architecture



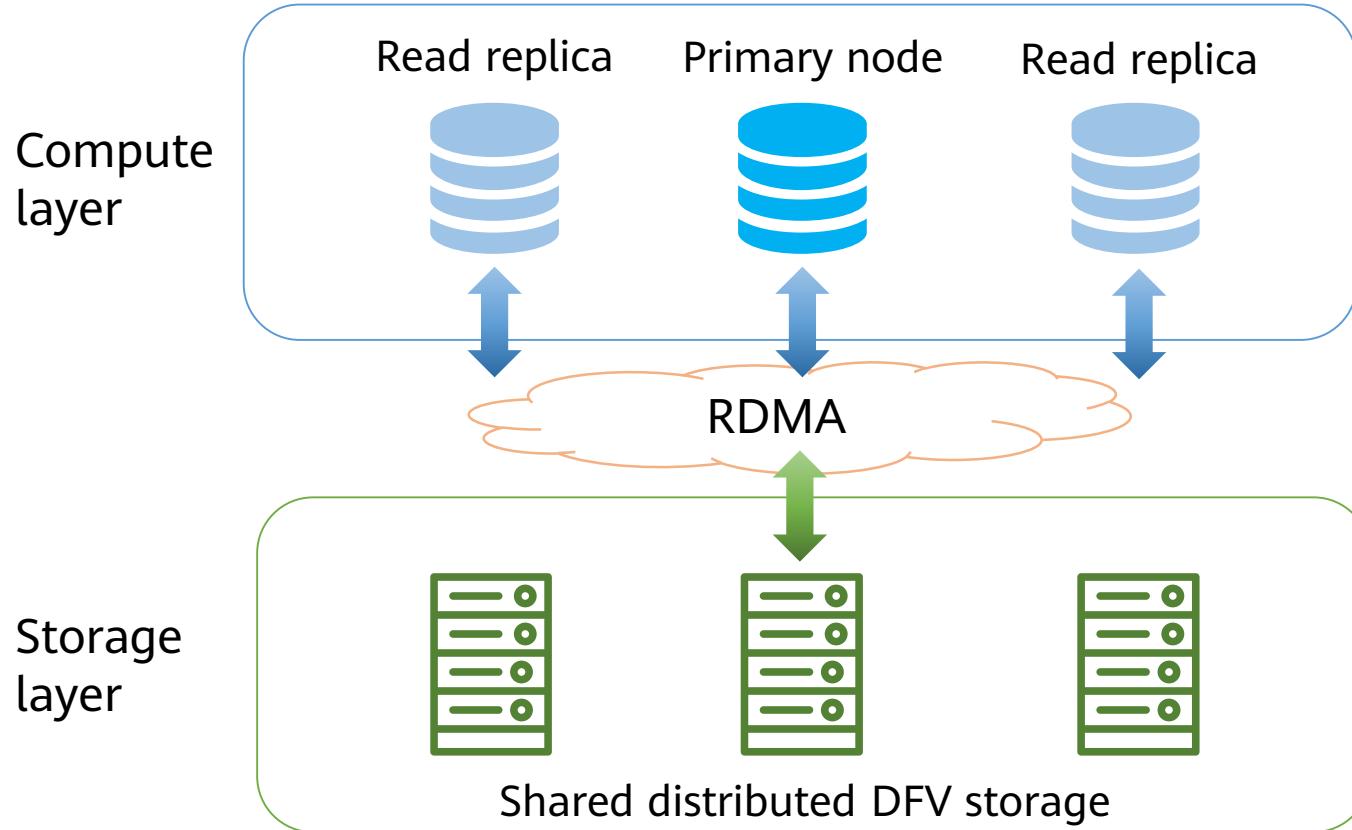
# Other Huawei Database Services



TaurusDB

- Huawei DB engine
- Compatible with MySQL clients
- Decoupled storage and compute
- Cross-AZ HA
- Three copies stored to ensure reliability
- Scale-out and scale-up

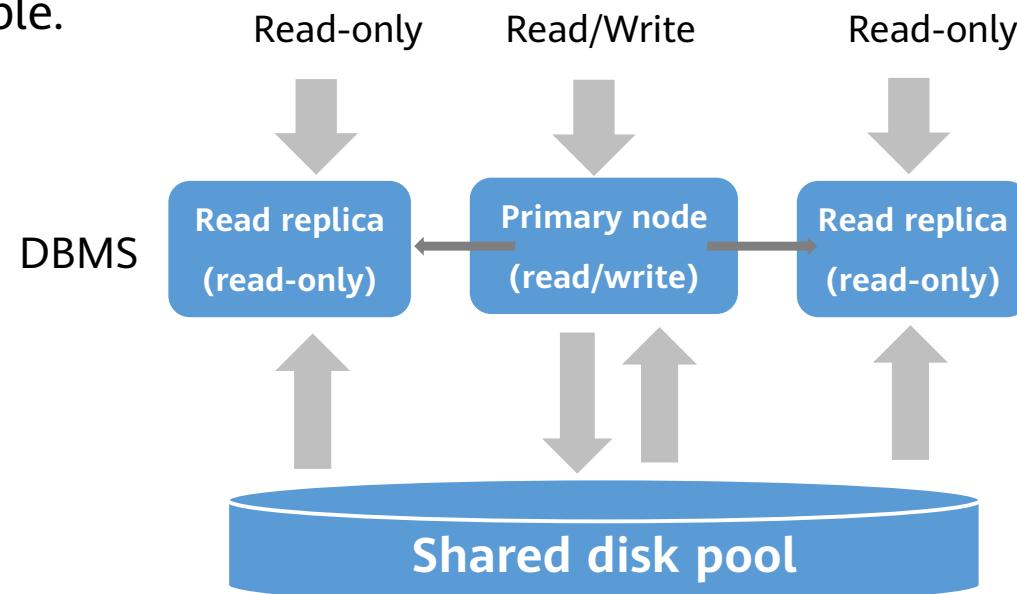
# Decoupled Storage and Compute



- Compute and storage are decoupled, improving performance to several times that of open-source MySQL.
- RDMA is used for database transmission, eliminating I/O performance bottlenecks.
- With DFV distributed storage, TaurusDB supports up to 128 TB of storage.

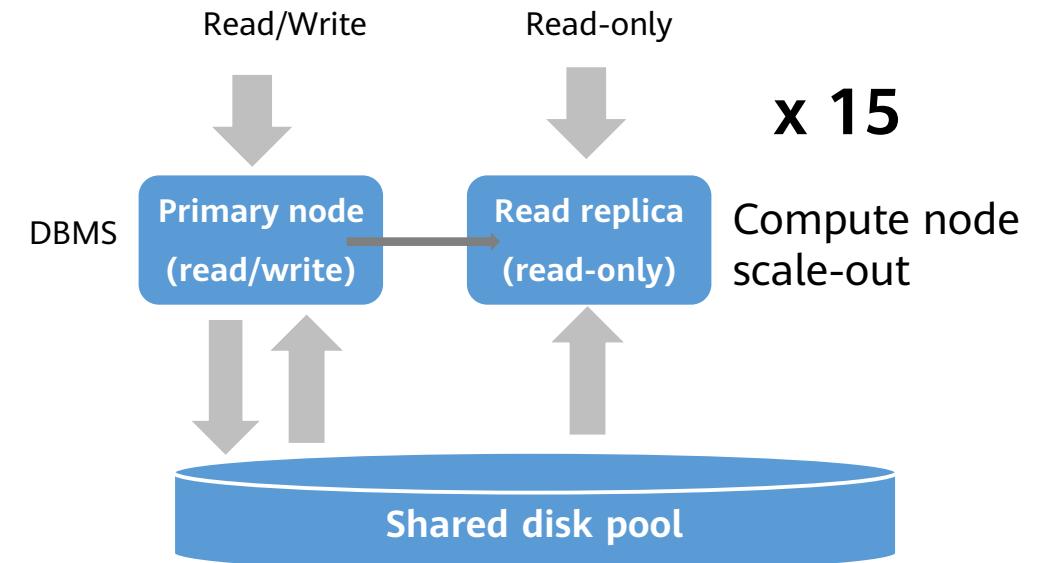
# High Reliability: Zero Data Loss and Fast Fault Recovery

- Cross-AZ deployment and cross-region backup, improving instance DR capabilities
  - Compute layer: When the primary node is faulty, a read replica is automatically promoted to primary, achieving a zero RPO.
  - Storage layer: Three data copies are stored for fault tolerance. Services will remain uninterrupted even if one copy becomes inaccessible.



# Multi-Dimensional Scaling and Mass Storage

- Bidirectional scaling of compute nodes
  - As the nodes are virtual resources, their specifications can be changed.
  - There can be one primary node and up to 15 read replicas for a DB instance.
- Storage pooling
  - Up to 128 TB of storage is supported per instance.
  - Adding compute nodes does not increase storage costs.
  - Storage is billed on a pay-per-use basis and can be easily scaled up with no downtime.



Three copies of a shared disk pool can support 15 nodes at the upper layer.

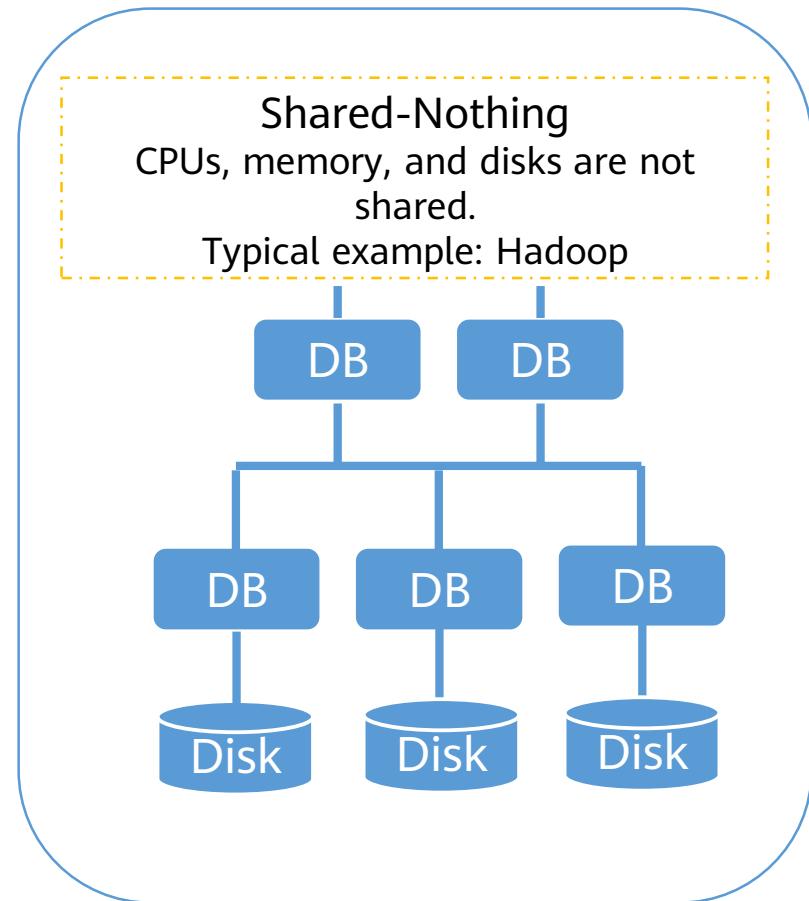
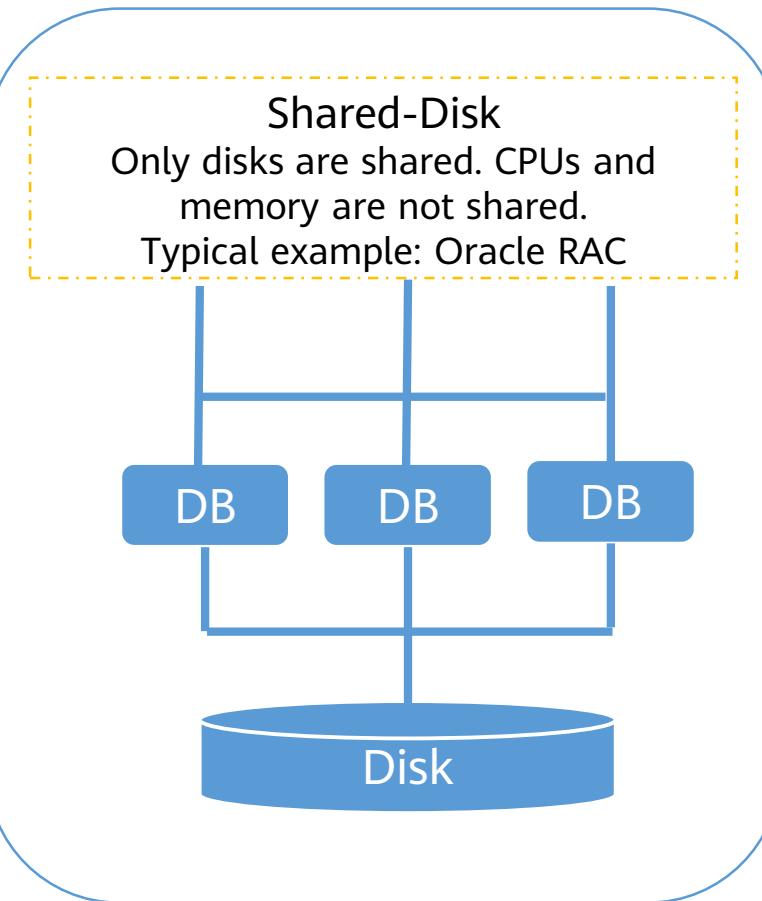
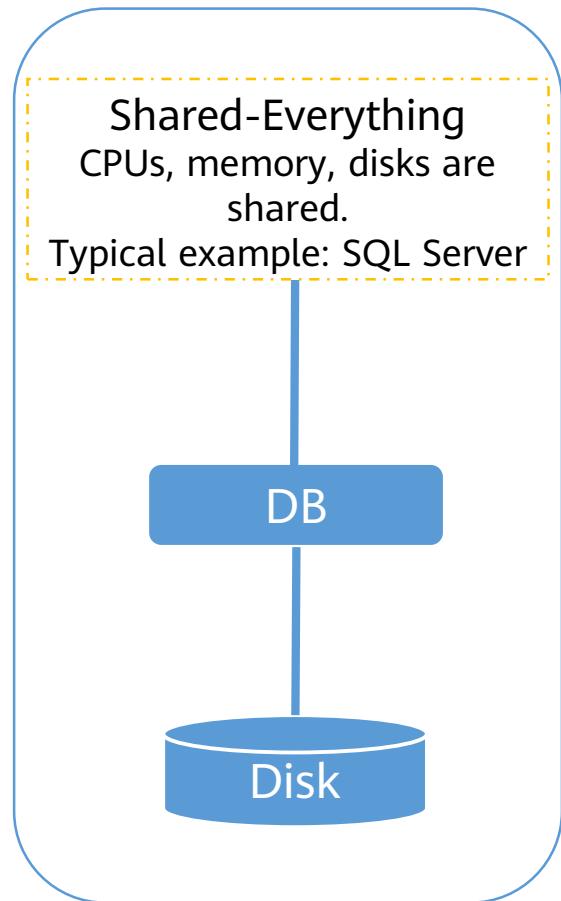
# A More Powerful Huawei Database Service



GaussDB

- Independent innovation from Huawei
- A distributed relational database
- Primary/Standby instances supported
- Intra-city cross-AZ deployment
- Up to 1,000+ nodes
- Petabytes of storage

# GaussDB Uses a Shared-Nothing (Sharding) Architecture



What will happen if there is a  
lot of concurrent data?



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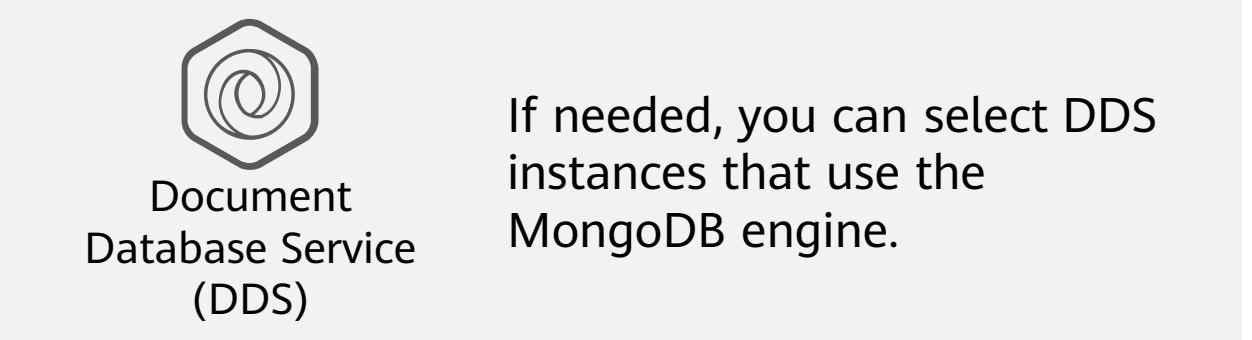
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# GeminiDB Features

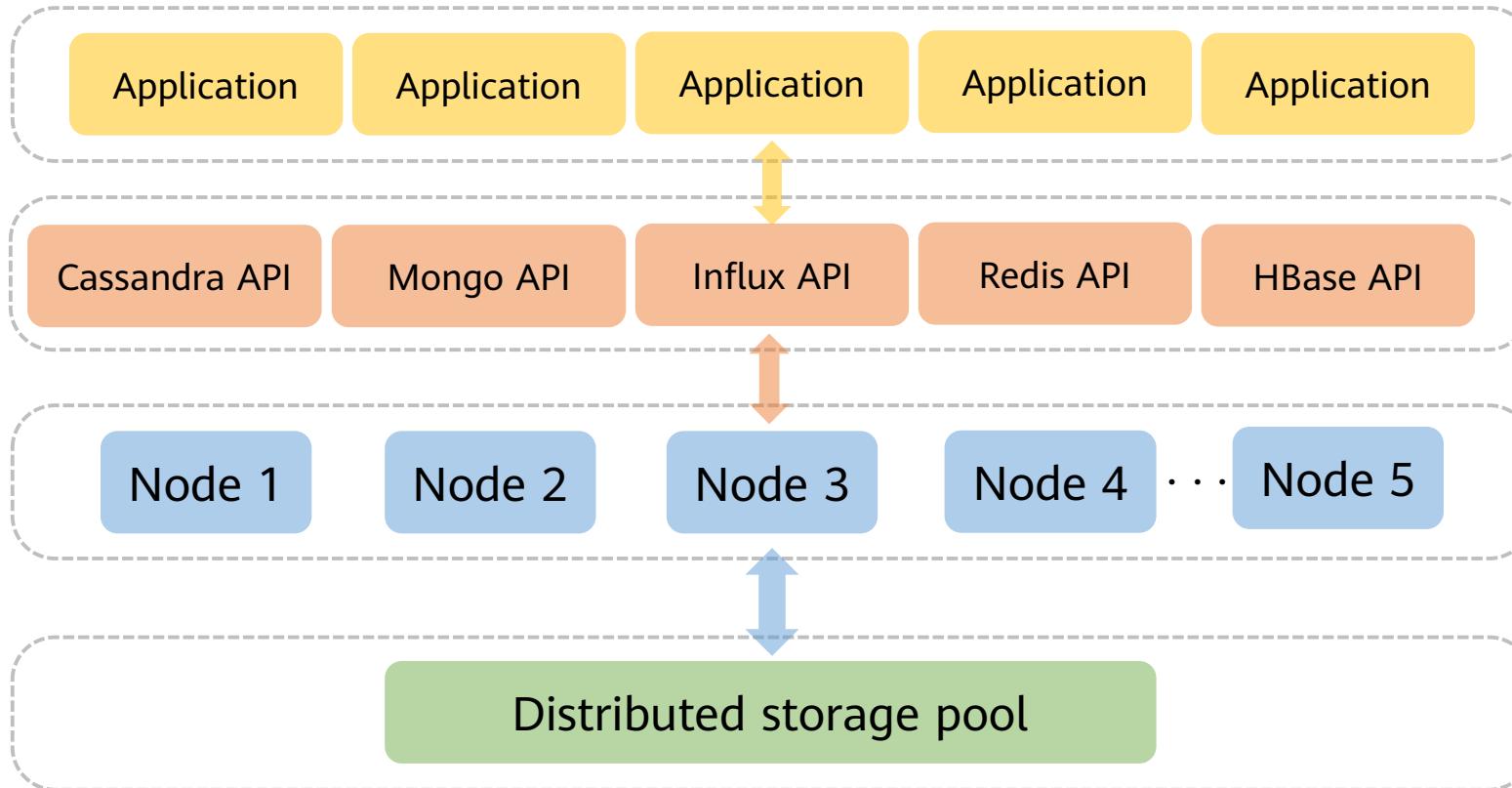


GeminiDB

- Huawei-developed DB engine
- Distributed multi-model NoSQL database service
- Compatible with mainstream NoSQL APIs of Cassandra, DynamoDB, MongoDB, InfluxDB, Redis, and HBase
- Decoupled storage and compute
- Compute resources scaled within minutes and storage within seconds



# GeminiDB Architecture



- **High availability**
  - If a compute node fails, workloads can be switched over within seconds.
  - Three copies of data are stored, so the system can run fine if a storage node fails.
- **Unlimited scalability**
  - Compute nodes are stateless and can be quickly scaled out.
  - Shared storage means you can add nodes in a click or two and without interrupting services.

# Features of Non-Relational Databases

01

Each data record is a structured document.

There are no logical relationships between the data records in a collection.

02

03

Users can locate data using key values rather than through complex queries.

# Precautions for Using Non-Relational Databases

- Define data keys and indexes so there is no need to scan entire collections, and data can be located faster.
  - Do not use hot keys.
  - Keep records simple.
  - Data can be located in milliseconds no matter how much data there is.
- If necessary, use optimistic locks for transactions at the application layer.
- If there is a lot of traffic, use clusters.
  - Select an appropriate sharding algorithm to locate data.
  - Distribute data access across all cluster nodes and avoid hot partitions.



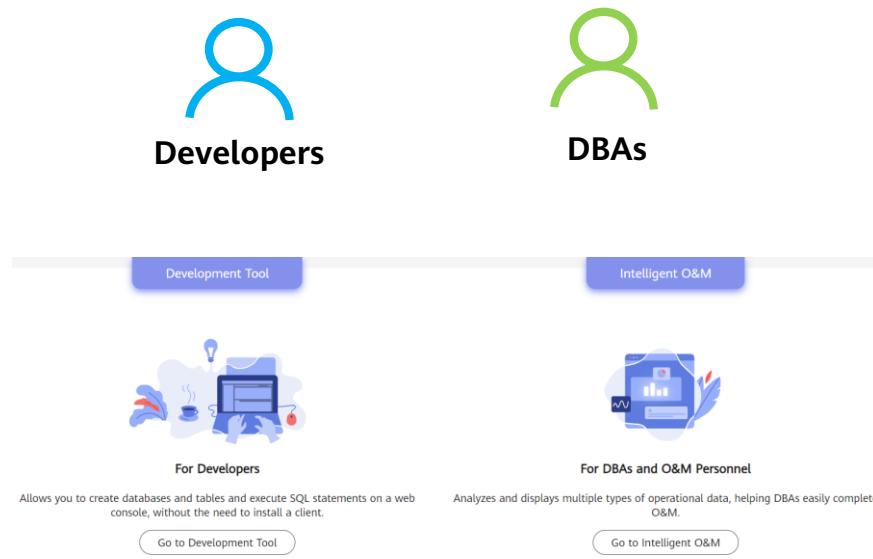
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# Data Admin Service (DAS)

- Data Admin Service (DAS) is a one-stop database management platform that allows you to manage Huawei Cloud databases on a web console. DAS offers database development, O&M, and intelligent diagnosis, making it easier to use and maintain databases on the cloud.

- No client required
- Visual operations
- Online access
- Databases and table creation, SQL statement execution.



- O&M functions
- Host and instance performance data analysis
- Slow and full SQL statement analysis
- Real-time database performance diagnosis and analysis
- Historical data analysis



# Summary

- Have a good command of basic concepts of databases.
- Have understood the characteristics of Huawei Cloud relational and non-relational database services.
- Have understood the differences between relational and non-relational databases.
- Have understood how to use databases to set up a service architecture.
- Have learned how to use DAS to manage your databases.



# Quiz

Which of the following are the advantages of Relational Database Service (RDS) over on-premises databases?

- A. High availability
- B. Elastic scaling and fast upgrade
- C. Easy O&M
- D. Low initial investment



# Acronyms and Abbreviations

- AZ: availability zone
- DAS: Data Admin Service
- DRS: Data Replication Service
- ECS: Elastic Cloud Server
- EVS: Elastic Volume Service
- OBS: Object Storage Service
- SFS: Scalable File Service
- EIP: Elastic IP
- VPC: Virtual Private Cloud
- RDS: Relational Database Service



# Recommendations

- Huawei Cloud websites
  - Huawei Cloud: <https://www.huaweicloud.com/intl/en-us/>
  - Huawei Cloud Developer Institute: <https://edu.huaweicloud.com/intl/en-us/>



Huawei Cloud  
Developer Institute

# Thank You.

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