06 Introduction to TencentDB Products

Course Objectives

- At the end of this course, you will have a better understanding of:
  - Database types and the features and functions of TencentDB products
  - The advantages and common use cases of TencentDB products
  - TencentDB billing modes

腾讯云

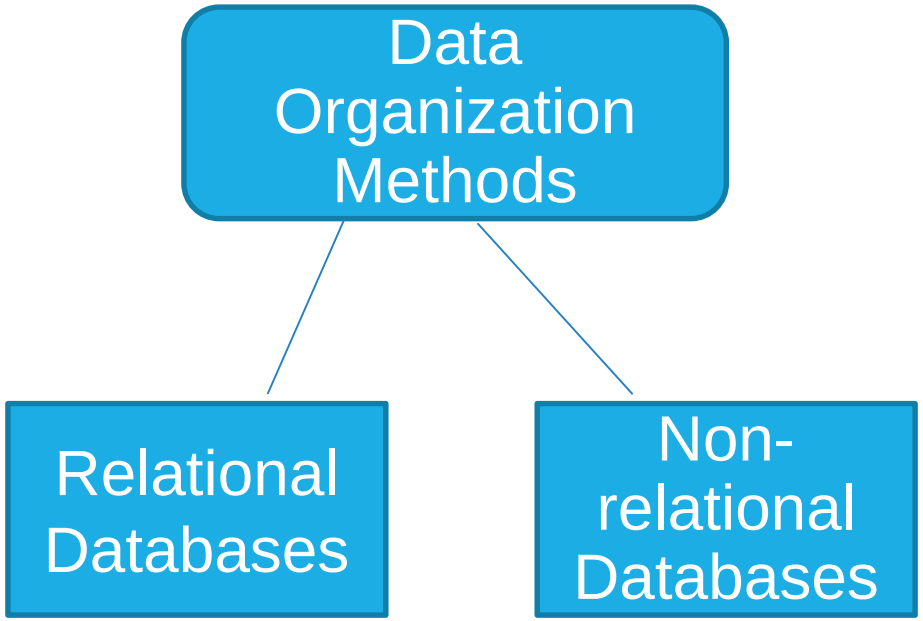
CONTENTS

腾讯云

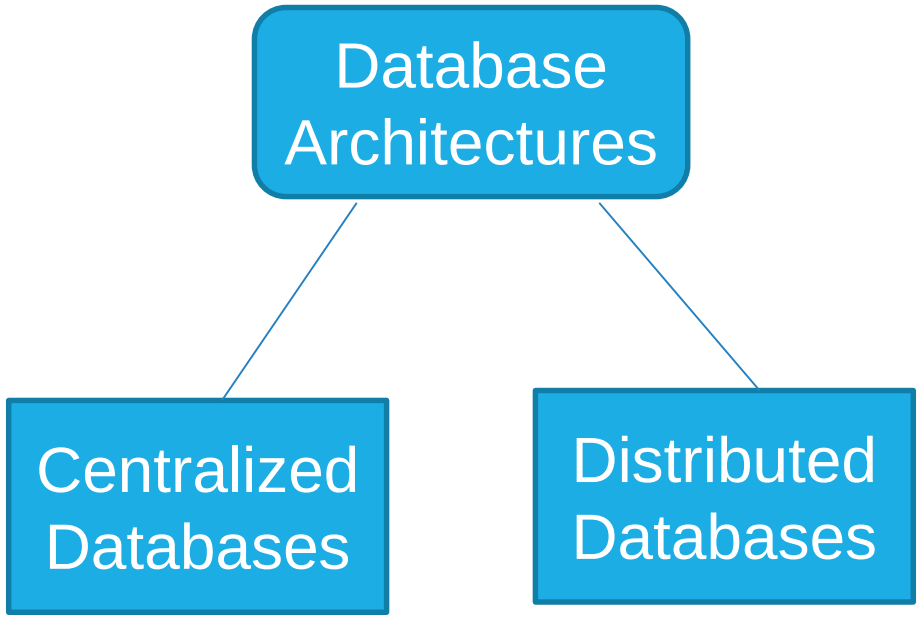
CONTENTS

Chapter 1 Basic Database Knowledge

1.1 Database Types



By data organization method



By architecture

1.1.1 Relational vs. Non-relational Databases

腾讯云

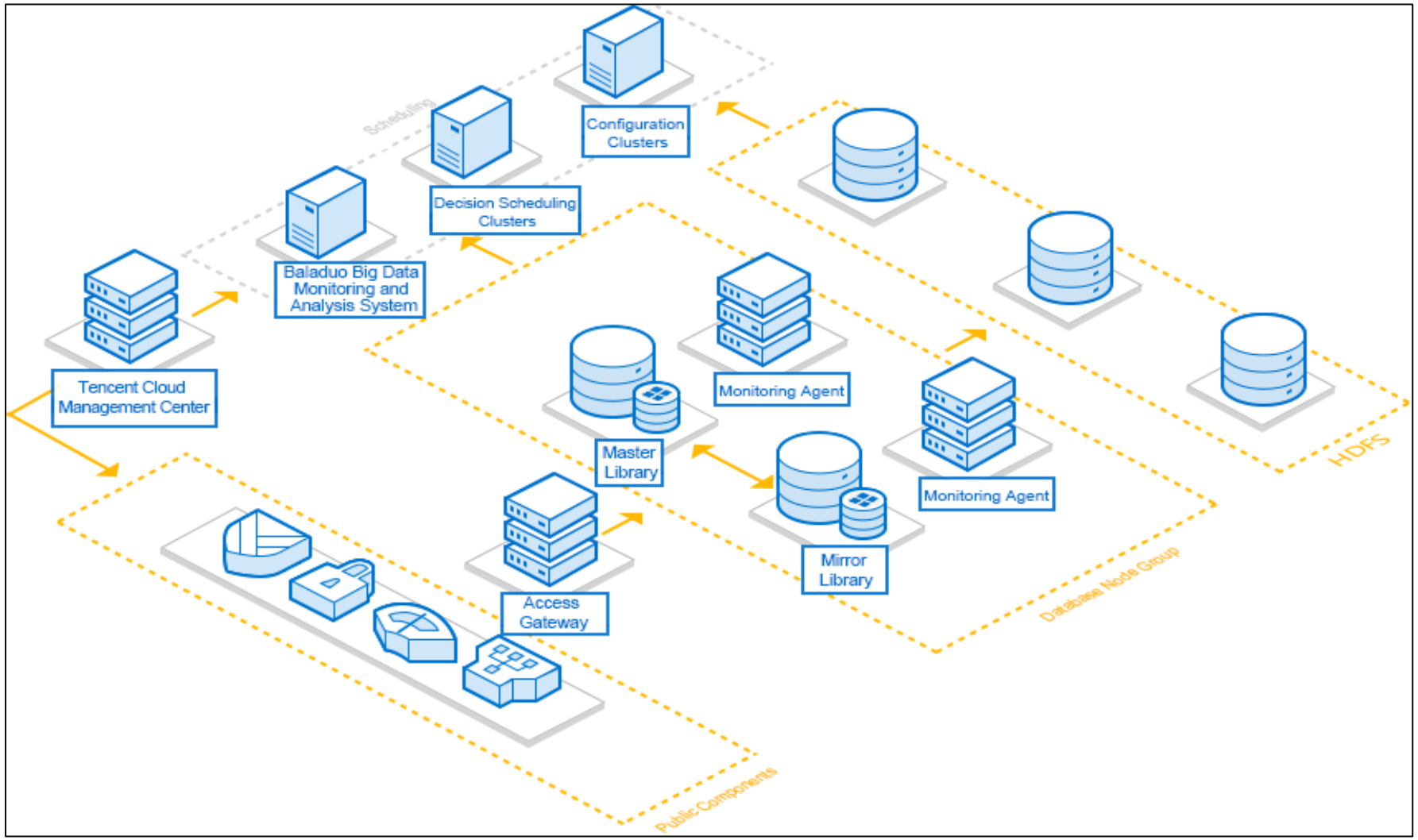
Item	Relational SQL	Non-relational NoSQL
Data storage	Relational tables	Data sets (key values/JSON docs/hash tables/other)
Schema	Structured and predefined tables	Dynamically adjusted and non-structured schema
Scalability	Scaling up is supported, and higher processing capabilities are provided.	Scaling out is supported, and more distributed nodes can be added.
Data query	Standard query language (SQL)	Non-standard unstructured query language (UnQL)
Key features	ACID	CAP and BASE
Pros	Structured, transactional, and easy to maintain	High scalability, flexible adjustment, and big data analytics
Cons	Low scalability, poor performance in high concurrency scenarios, and no support for big data analytics	Weak support for transaction processing and lack of standardization

1.1.2 Mainstream Relational Databases

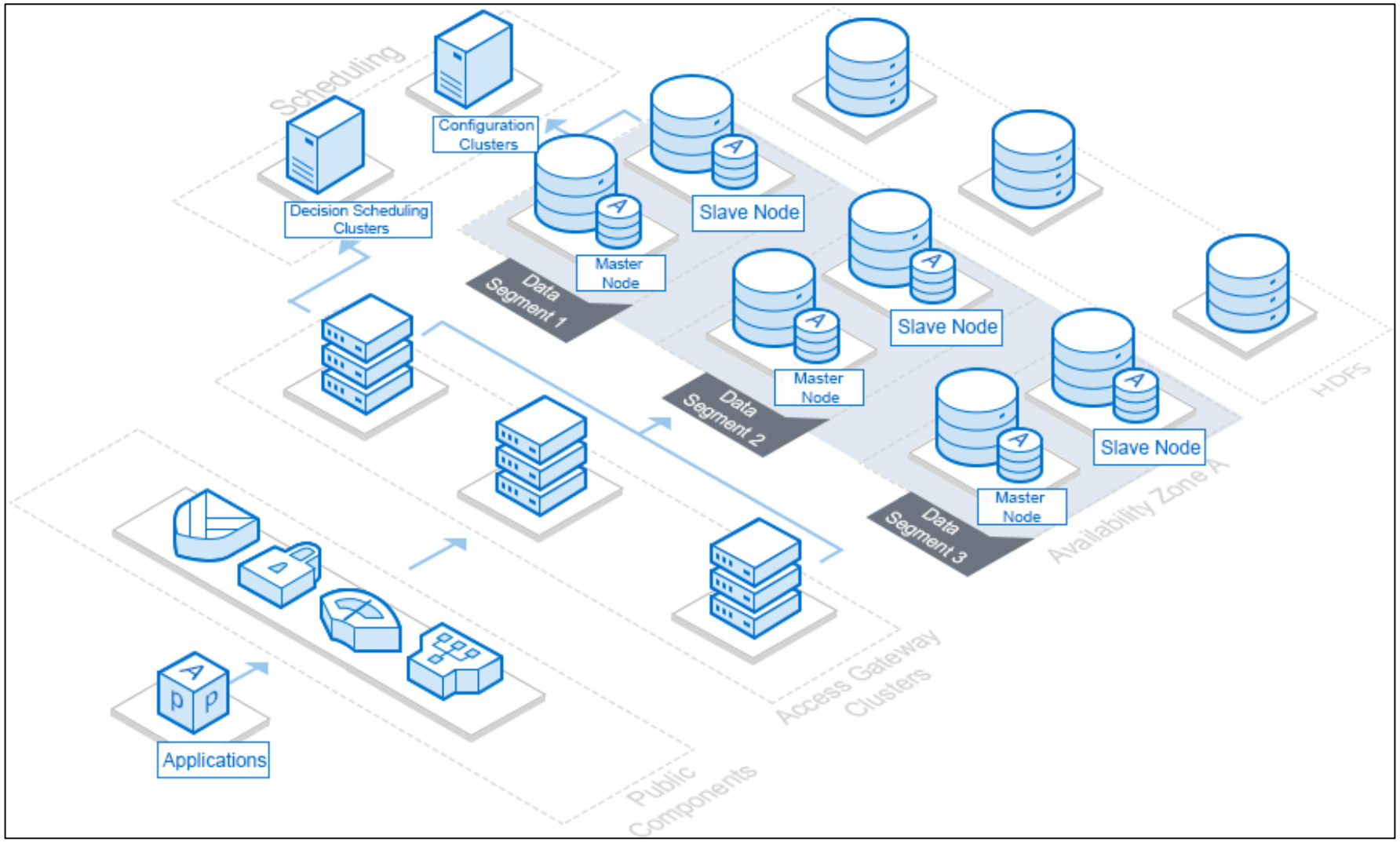
1.1.3 Mainstream NoSQL Databases

Type	Key feature	Mainstream products	Use cases
Key-value database	Uses hash tables to store keys and corresponding pointers that point to specific data.	Redis and Memcached	Content caching and online shopping carts
Document database	Stores data as documents (JSON/BSON/XML) in schema-free structures	MongoDB and CouchDB	Application log systems and websites/blog platforms
Column database	Stores data by column, with keys paired with pointers that point to multiple columns	HBase and Cassandra	Distributed file systems and big data analytics
Graph database	Stores data by using graphs, with nodes storing entities and edges storing relationships between entities	Neo4J, InfoGrid, and Infinite Graph	Social networks and recommendation engines

1.1.4 Centralized Database Structure Example



1.1.5 Distributed Database Structure Example



1.2 Database Ranking

345 systems in ranking, April 2019

Rank Apr 2019	Rank Mar 2019	Rank Apr 2018	DBMS	Database Model	Score Apr 2019	Score Mar 2019	Score Apr 2018
1.	1.	1.	Oracle	Relational, Multi-model	1279.94	+0.80	-9.85
2.	2.	2.	MySQL	Relational, Multi-model	1215.14	+16.89	-11.26
3.	3.	3.	Microsoft SQL Server	Relational, Multi-model	1059.96	+12.11	-35.55
4.	4.	4.	PostgreSQL	Relational, Multi-model	478.72	+8.91	+83.25
5.	5.	5.	MongoDB	Document	401.98	+0.64	+60.57
6.	6.	6.	IBM Db2	Relational, Multi-model	176.05	-1.15	-12.89
7.	↑ 8.	↑ 9.	Redis	Key-value, Multi-model	146.38	+0.25	+16.27
8.	↑ 9.	8.	Elasticsearch	Search engine, Multi-model	146.00	+3.21	+14.64
9.	↓ 7.	↓ 7.	Microsoft Access	Relational	144.65	-1.55	+12.43
10.	10.	↑ 11.	SQLite	Relational	124.21	-0.66	+8.23
11.	11.	↓ 10.	Cassandra	Wide column	123.61	+0.81	+4.52
12.	12.	↑ 14.	MariaDB	Relational, Multi-model	85.23	+0.92	+20.67
13.	13.	13.	Splunk	Search engine	83.09	-0.01	+18.03
14.	14.	↓ 12.	Teradata	Relational	75.35	+0.13	+1.67
15.	15.	↑ 18.	Hive	Relational	74.71	+1.71	+17.31
16.	16.	↓ 15.	Solr	Search engine	60.22	+0.21	-2.99
17.	17.	17.	HBase	Wide column	58.66	-0.13	-1.03
18.	18.	↑ 19.	FileMaker	Relational	58.42	+0.30	+3.42
19.	↑ 21.	↑ 21.	Amazon DynamoDB	Multi-model	56.01	+1.52	+12.86
20.	↓ 19.	↓ 16.	SAP Adaptive Server	Relational	55.80	-0.23	-5.83
21.	↓ 20.	↓ 20.	SAP HANA	Relational, Multi-model	55.34	-0.17	+6.45
22.	22.	22.	Neo4j	Graph	49.49	+0.91	+8.59
23.	23.	↑ 24.	Couchbase	Document	36.28	+2.49	+3.95
24.	↑ 25.	↑ 26.	Microsoft Azure SQL Database	Relational, Multi-model	28.79	+0.87	+4.33
25.	↓ 24.	↓ 23.	Memcached	Key-value	28.73	0.00	-5.06

1.3 Database Trends

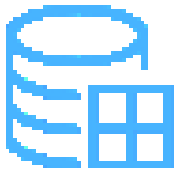
- **Integration:**
  - Software and hardware: All-in-one database
  - NoSQL and SQL: NewSQL
  - OLAP and OLTP: HTAP
  - DBMS and AI
- **Breakthroughs:**
  - Massive data processing: Big data analytics
  - High performance: Clusters, distributed architectures, and low-latency
  - Stability: Data replication and disaster recovery
  - Architecture: Optimized kernels and cloud-native databases

1.4 Tencent Cloud Database — TencentDB

- **Relational databases:**


MySQL


MariaDB


SQL Server


PostgreSQL


TDSQL


CynosDB

- **NoSQL databases:**


Redis


Memcached


MongoDB


CTSDB


HBase


TcaplusDB

- **Database services:**


DTS


TData

腾讯云

CONTENTS

Chapter 2 TencentDB for Relational Databases

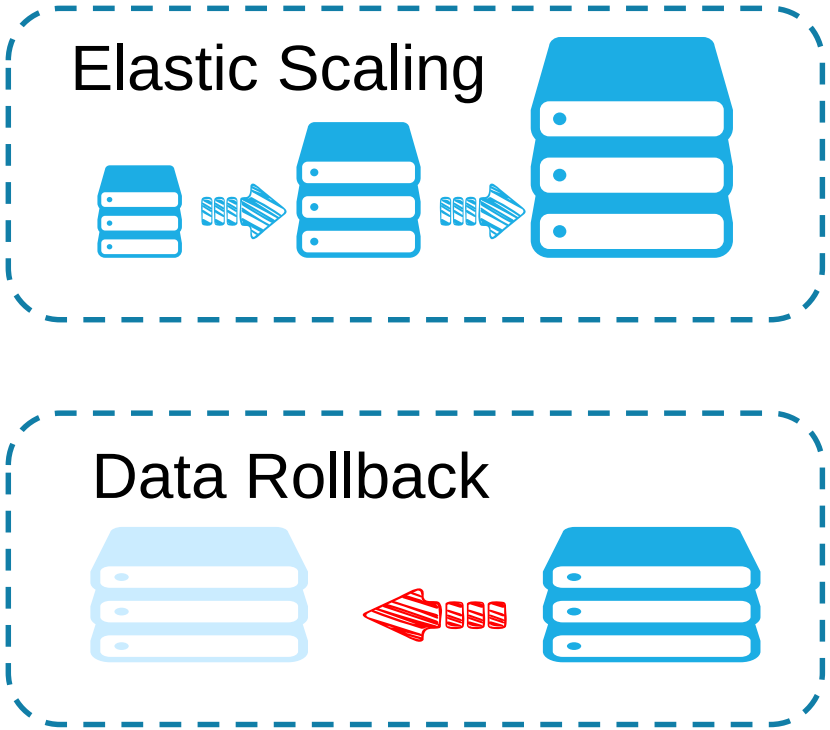
2.1 TencentDB for MySQL

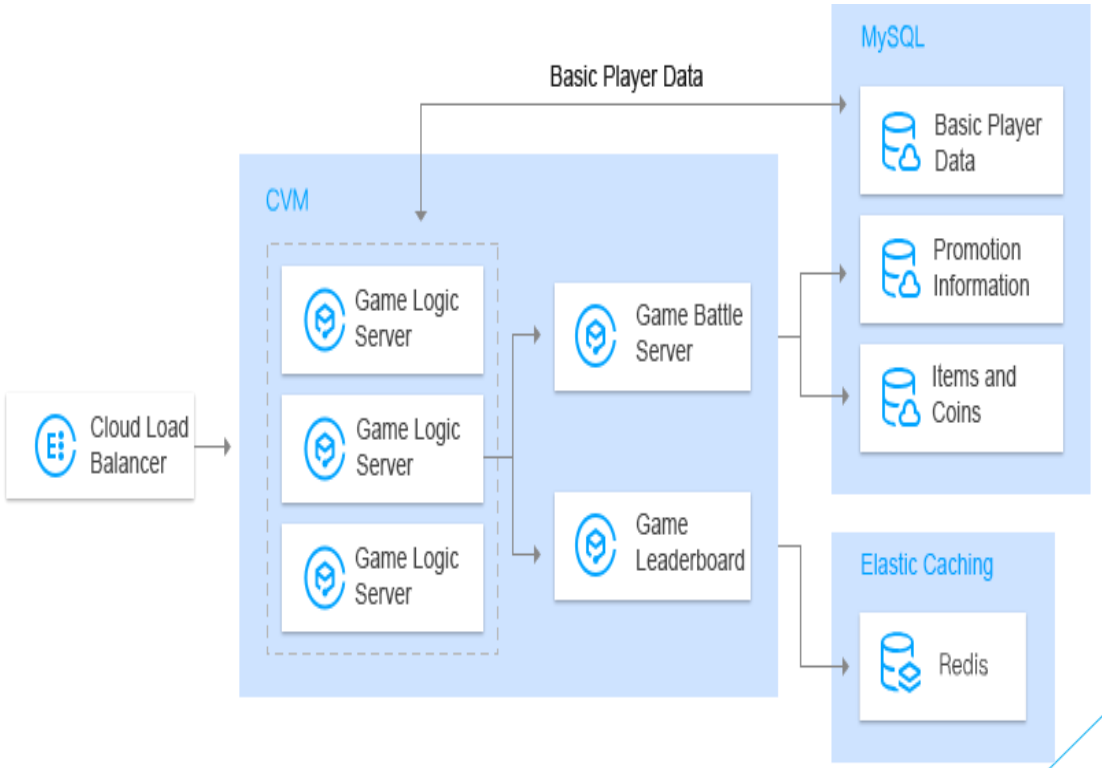
- TencentDB for MySQL allows users to deploy and use MySQL databases in the cloud.

- **Compatibility**
  - 100% compatible with the open-source MySQL protocol
- **Optimized performance**
  - Optimized MySQL kernel
  - Optimized I/O performance with the PCI-e SSD
  - 240,000 QPS and 6 TB storage space per instance
  - Multiple slaves for one master, support Read/Write separation
- **Security**
  - Data encryption and database auditing
- **High availability**
  - Real-time hot backup and binlog-based lossless data recovery within five days
  - Automatic disaster recovery, automatic fault detection, and transparent master/slave switchover and migration

2.1 TencentDB for MySQL: Gaming

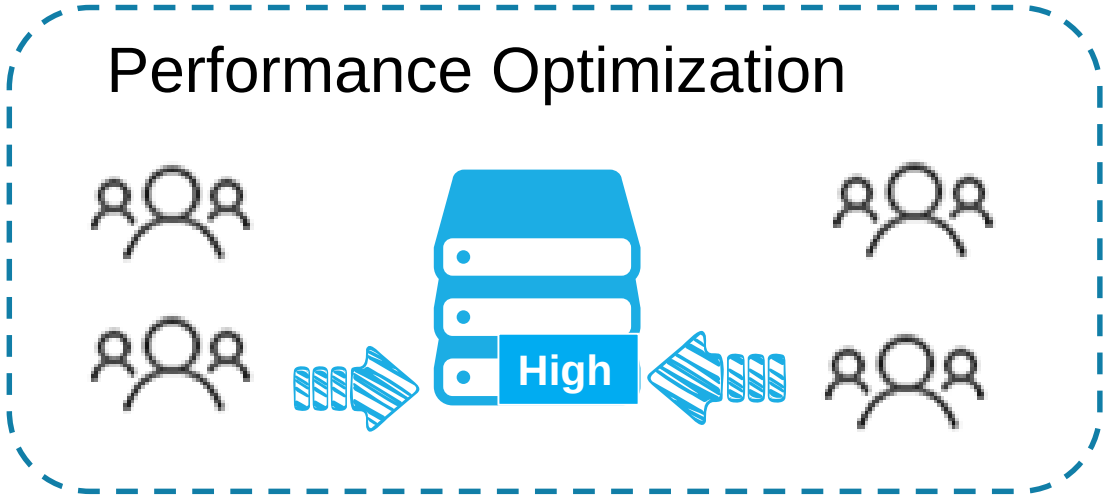
- **Requirements:** Resource allocation based on the number of players; multiple save and roll-back data points
- **Solution:** Elastic scaling and quick rollback

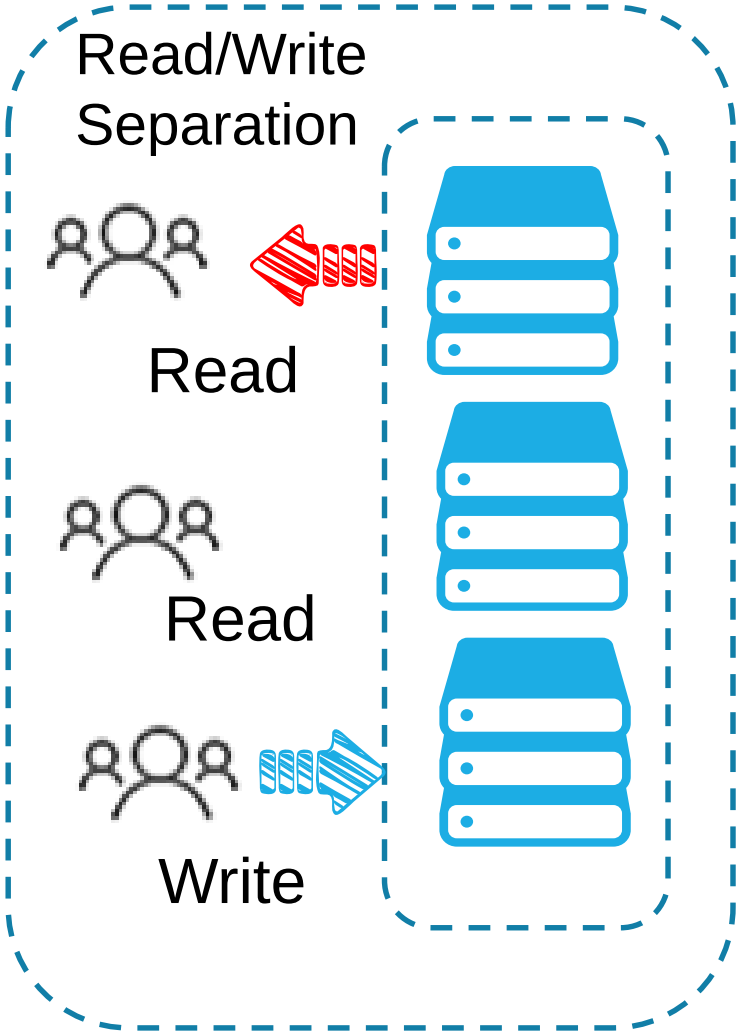




2.1 TencentDB for MySQL: Mobile Apps

- Requirements: High-concurrency access, WRRM (Write Rarely, Read Mostly) support
- Solution: Read/Write separation and performance optimization





2.2 TencentDB for SQL Server

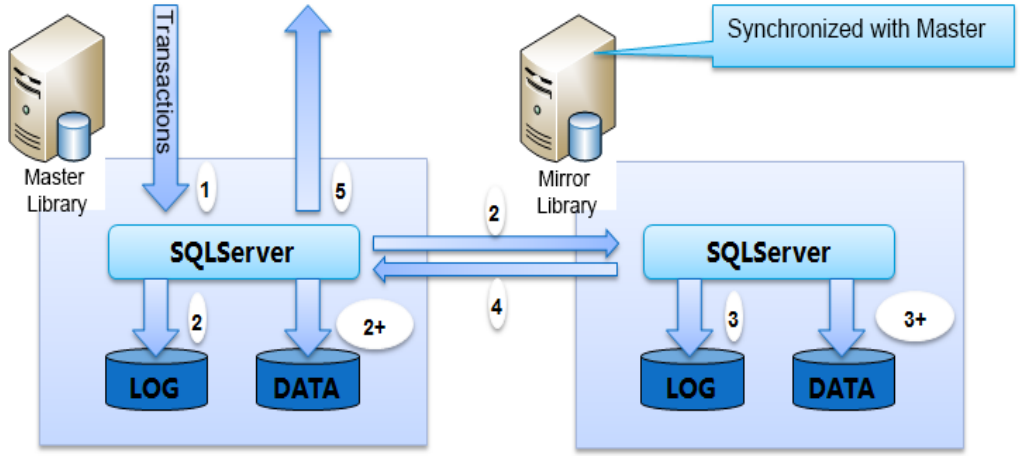
- SQL Server is a commercial relational database developed by Microsoft based on Windows.
- **TencentDB for SQL Server** has an official license from Microsoft to deploy and use SQL Server in the Cloud.

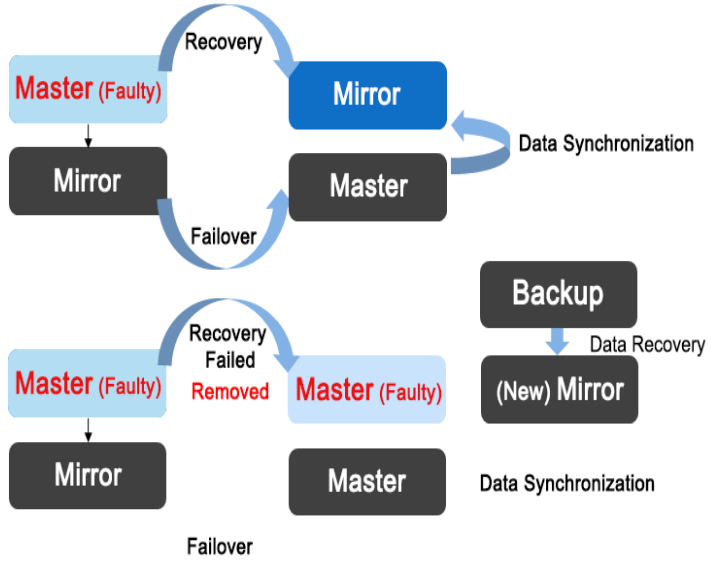
- **Supported versions:**
  - SQL Server 2008 R2 SP3
  - SQL Server 2012 SP3
  - SQL Server 2016

- **Product features:**
  - Genuine license
  - Stable and reliable
  - Superior performance
  - Convenient management

2.2 SQL Server Mirroring Mechanism

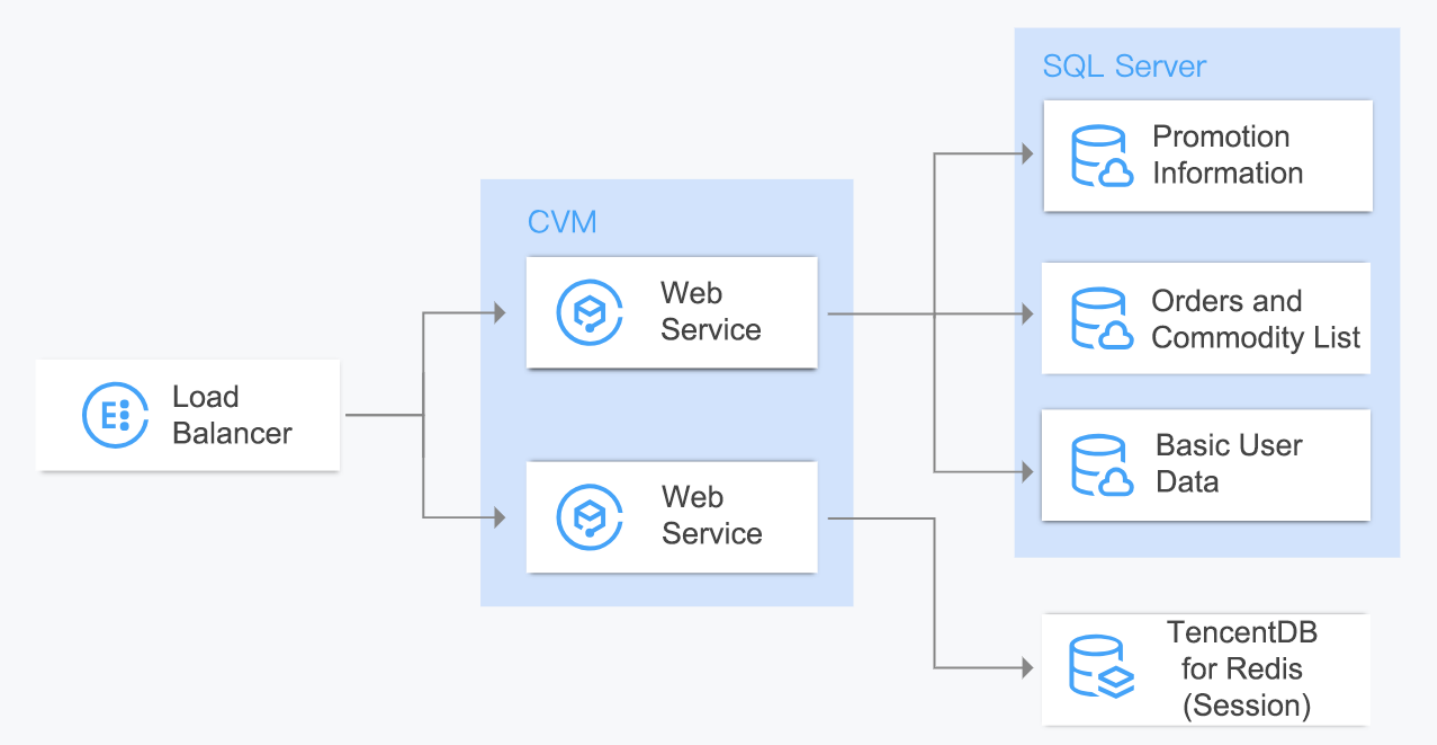
- Database Mirroring achieves high-availability replication:
  - Each database corresponds to a monitor agent set, which monitors the database in real time through heartbeat messages.
  - If a node fails, the system automatically resumes services or establishes a connection to another node. Node switching is transparent to users.





2.2 TencentDB for SQL Server: Windows

- TencentDB for SQL Server combined with Windows can help enterprise users quickly deploy OA, ERP, and sales management platforms.



2.3 TencentDB for PostgreSQL

- PostgreSQL is an open-source NewSQL database that integrates the features of SQL and NoSQL. It has become the preferred open-source relational database for commercial use.

- TencentDB for PostgreSQL allows users to conveniently configure, use, and scale PostgreSQL databases in the cloud.
  - More features
  - Ultra-high performance
  - High reliability
  - Convenient management

2.3 TencentDB for PostgreSQL Use Cases

- TencentDB for PostgreSQL is best suited for OLAP or OLTP operations that process complex SQL statements, such as complex computing or geographical and spatial information processing.
  - **Enterprise applications:** ERP, transaction systems, and financial systems
  - **LBS-related applications:** Large games and O2O applications
  - **Data warehousing and big data:** More data types and advanced analysis
  - **Site or application creation:** Custom functions and data formats with full-text search

2.3 OLTP vs. OLAP

Feature	OLTP	OLAP
Use cases	Daily transaction processing	Statistics, statements, and analysis
Target services	Real-time transaction services, such as e-commerce transactions and orders	Statistical analysis services, such as the ERP and BI
Performance bottleneck	Disk I/O	CPU computing power
Timeliness	Real-time reading/writing	Does not require real-time reading/writing

2.4 TencentDB for MariaDB/TDSQL

- **MariaDB** was created by the founder of MySQL, who has promised to keep the application open source. It is highly compatible with MySQL.
- **TencentDB for MariaDB** is an enterprise-level cloud database that features high security and high performance.
- **TencentDB for TDSQL:**
  - TDSQL is a kernel branch of the finance-level distributed database MariaDB maintained by Tencent Cloud. It supports automatic horizontal sharding, which allows logical tables to be perceived as a whole by services while data is evenly sharded into physical segments. TDSQL was developed to solve the following problems:
    - ✓ Standalone database bottlenecks
    - ✓ The heavy development workload of application-layer sharding
    - ✓ Inadequate OPS support for open-source NoSQL databases

2.4 Advantages of TencentDB for MariaDB

Multi-thread Asynchronous Replication (MAR)

- Guaranteed data consistency
- Improved performance with reconstructed thread pool model
- Finance-level strict consistency

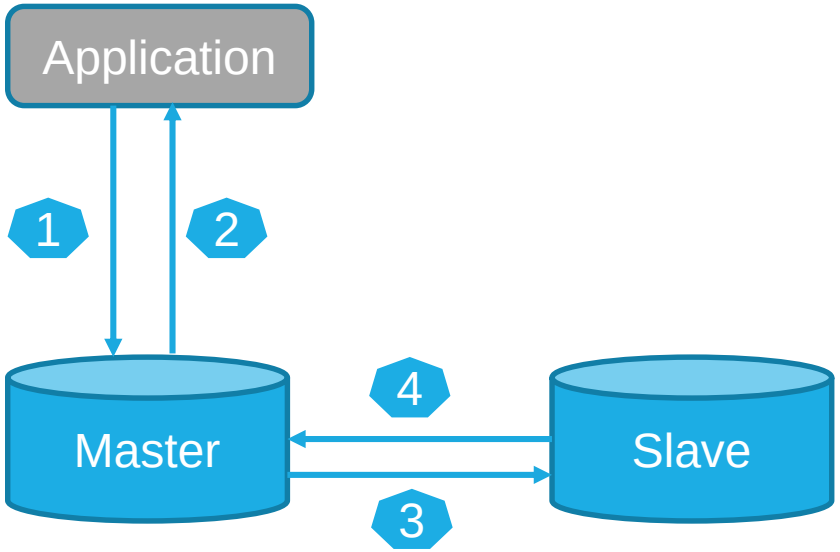
High Availability

- Multiple slaves for one master and transparent failover
- Real-time automatic instance monitoring and recovery
- Deployed in multiple availability zones for backup and rollback

High Performance

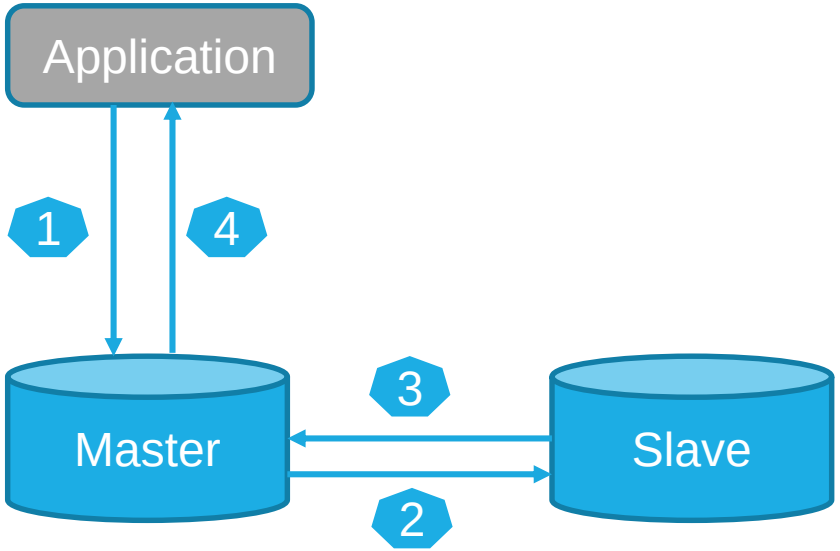
- OLTP-oriented
- Deep customization for kernel optimization
- Read/Write separation for performance boost

2.4 Data Replication Modes



Async

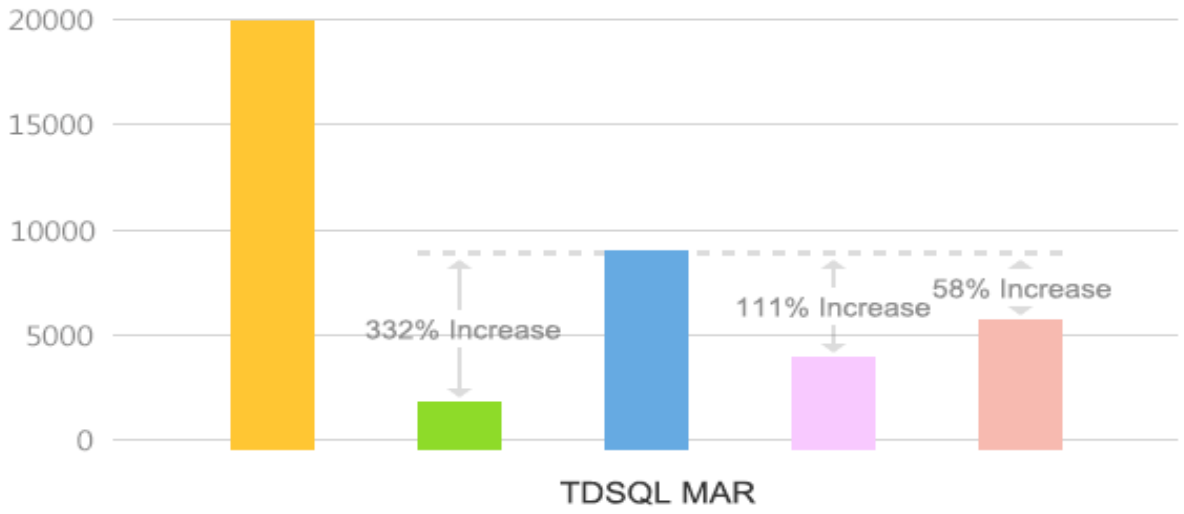
Semi-sync



Full sync - MAR

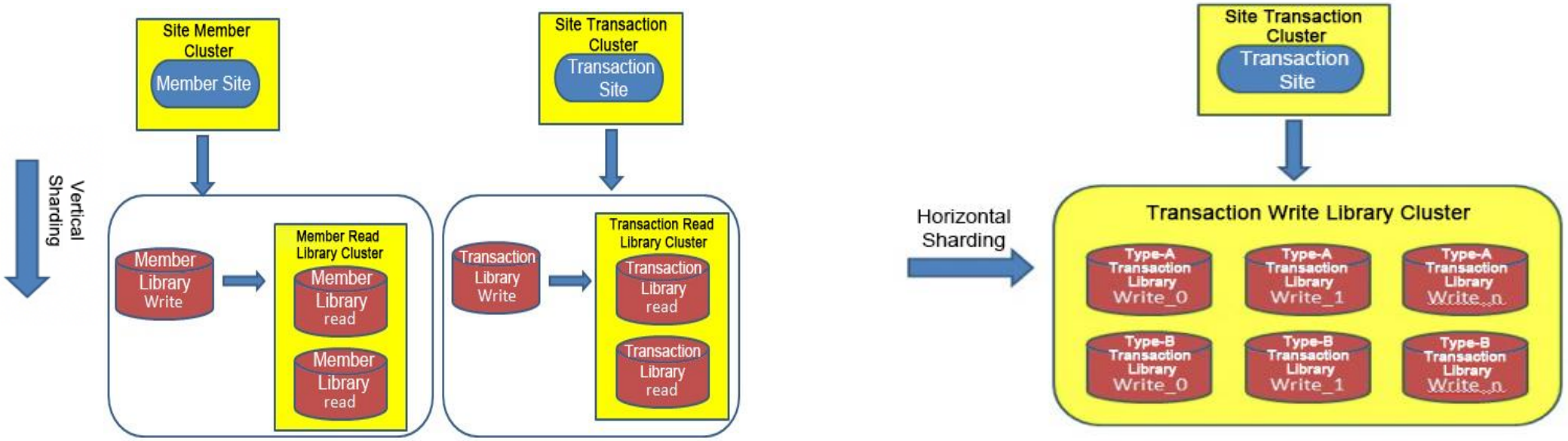
2.4 MAR

- **Tencent has a self-developed Multi-thread Asynchronous Replication (MAR) solution that provides:**
  - **Strict data consistency:** Each node includes a complete data replica and can be switched at any time.
  - **Transparent service layer:** Read/Write separation and enhanced synchronization are not required at the service layer.
  - **Optimized performance:** Asynchronization of serial synchronous threads and thread pooling.
  - **Automatic management and control:** Automatic member control, faulty nodes are automatically removed from the cluster.

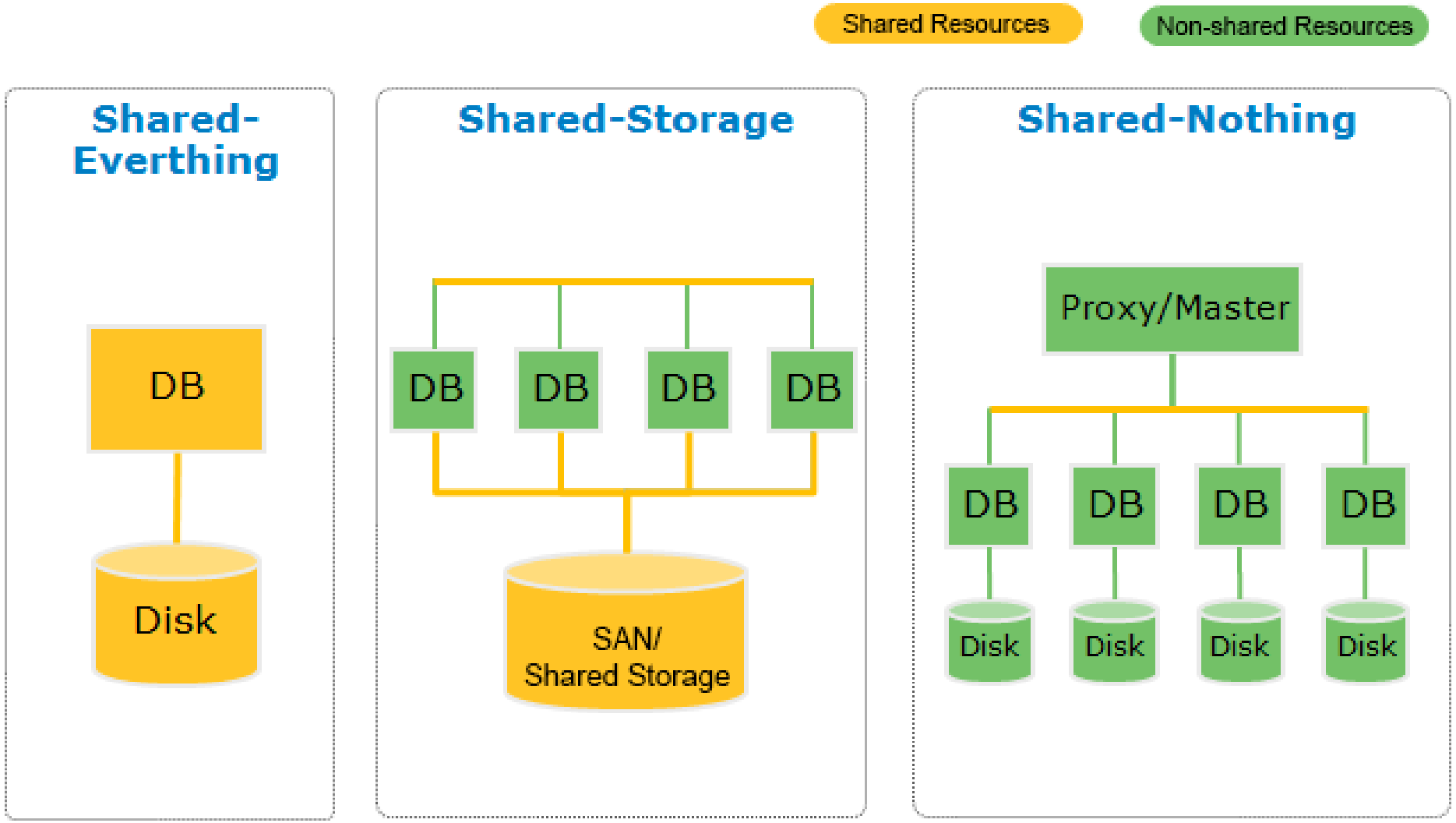


2.4 TDSQL Horizontal Sharding

- **Vertical sharding:** Stores different service application content in different databases.
- **Horizontal sharding:** Splits one database into multiple standalone physical segments.

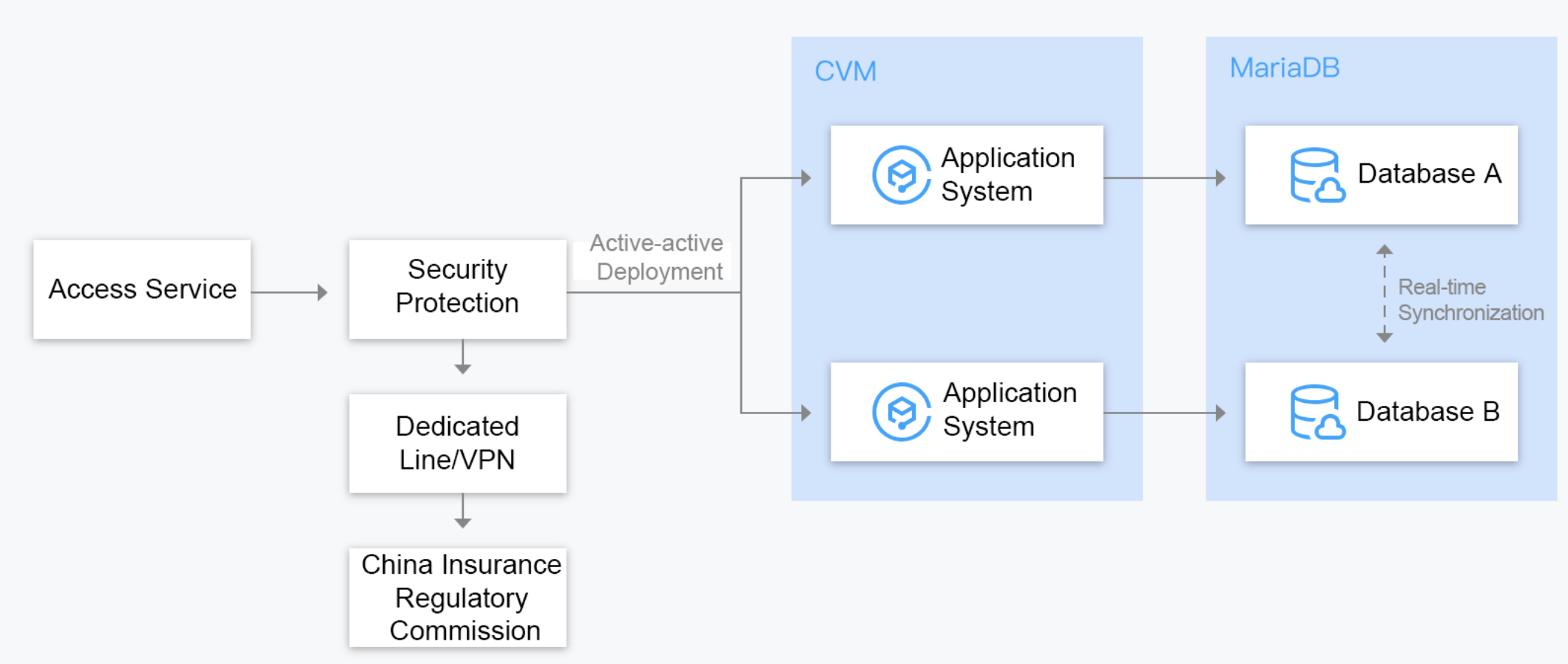


2.4 TDSQL Shared-Nothing Architecture



2.4 TencentDB for MariaDB: Financial Services

- Requirements: High consistency, high performance, high concurrency



2.4 TDSQL Use Cases

- Large-scale applications: real-time transaction systems with ultra-high concurrency
- Internet of Things: accesses petabyte-scale data storage
- File indexing: accesses billions of rows of data in milliseconds
- Highly cost-effective commercial database solutions

2.5 TencentDB for CynosDB

CynosDB is an enterprise-level cloud-native distributed database developed by Tencent:

- High performance: Up to 1.3 million QPS when reading a single node, eight times that of MySQL and four times that of PostgreSQL.
- Large capacity: Up to 128 TB of storage and support for automatic scaling.
- Low costs: 1/15 of the price of a general-purpose commercial database.
- Compatibility: 100% compatible with MySQL and PostgreSQL.
- Quick recovery: Stateless node computing, failover and recovery in seconds, and backup and rollback in seconds.

CynosDB Version	Database Version
MySQL-compatible versions	MySQL 5.7
PostgreSQL-compatible versions	PostgreSQL 10

2.5 CynosDB Optimizations

Kernel customizations	More than 60 optimizations enable various enterprise features.
Log as a database	WAL logs accumulate at the storage layer to minimize network I/O.
Hardware and software optimizations	Zero-copy technologies such as SPDK and RDMA reduce performance loss due to system switching.
Elastic scaling	CynosFS automatically scales in and out, and automatically detects faults.

2.5 TencentDB for CynosDB Use Cases

- **Enterprise applications:**
  - High performance, high availability, and low costs

- **Internet or gaming services:**
  - Large capacity, elastic scaling, backup and rollback in seconds

腾讯云

CONTENTS

Chapter 3 TencentDB for Non-relational Databases

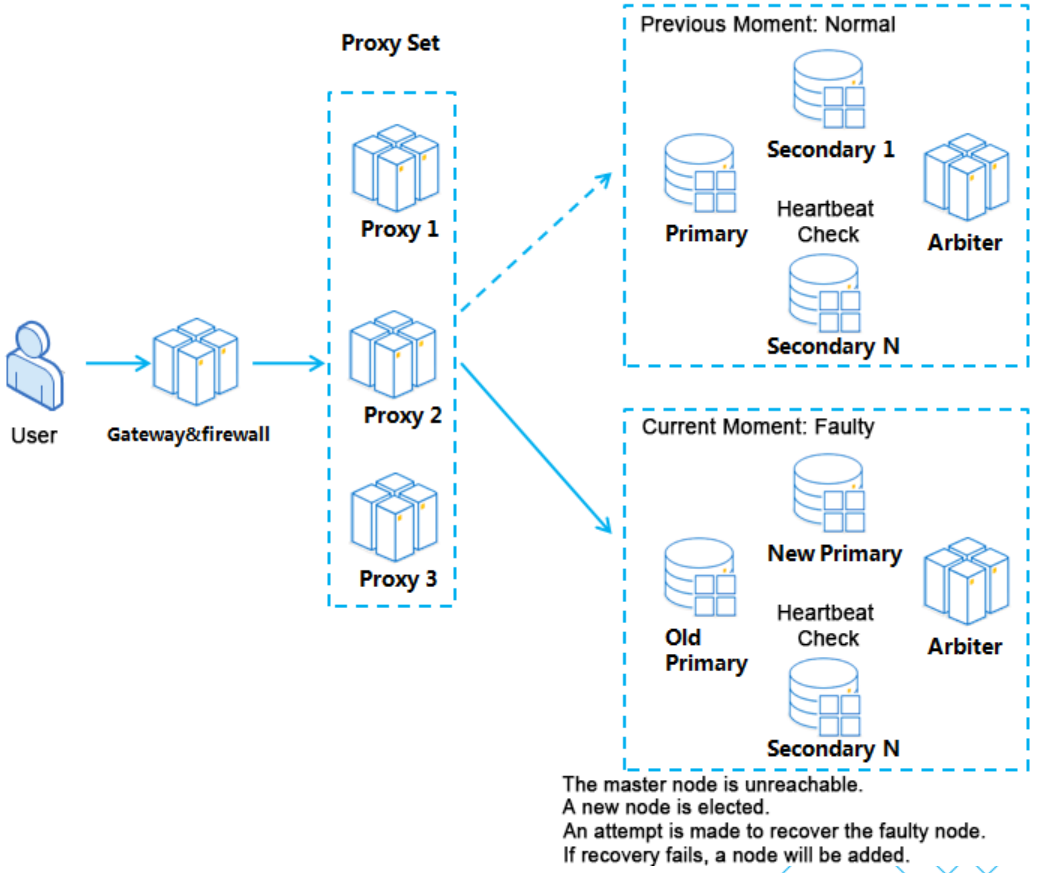
3.1 TencentDB for MongoDB

TencentDB for MongoDB

- Based on the open-source MongoDB program, TencentDB for MongoDB is a high-performance distributed document database service:
  - Compatible with the open-source MongoDB and DynamoDB protocols
  - Supports distributed cluster construction
  - Schema-free
  - High performance: over 30,000 QPS
  - Automatic disaster recovery, backup, and rollback

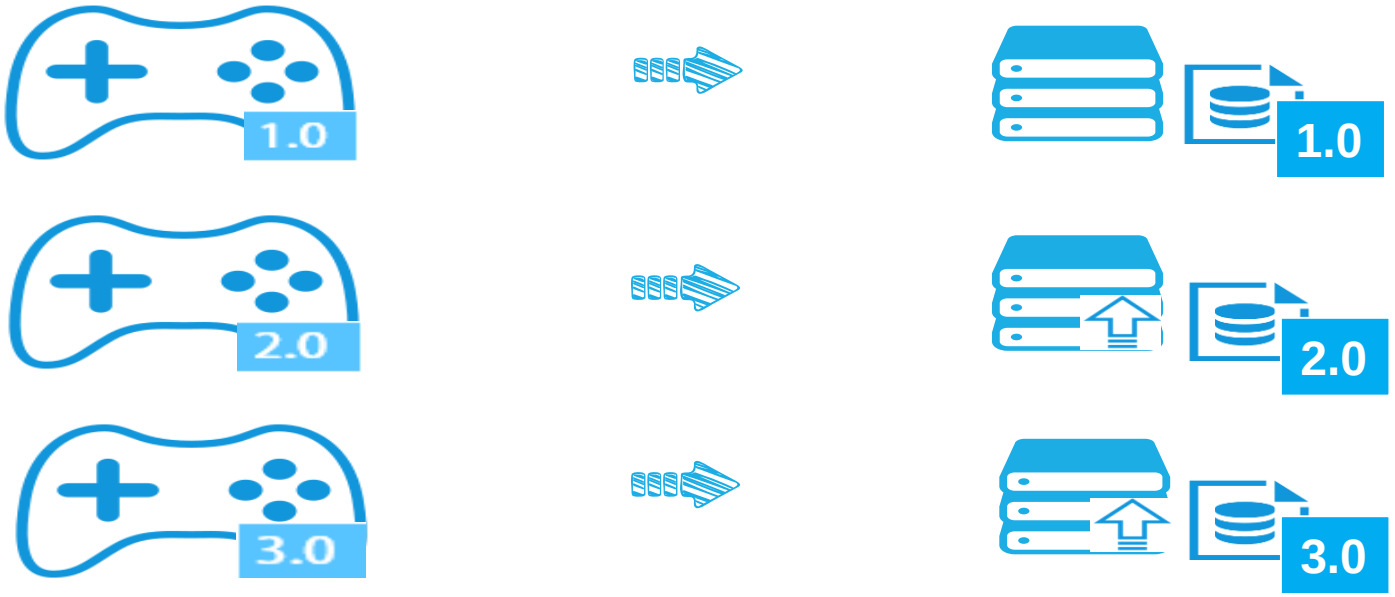
3.1 TencentDB for MongoDB Disaster Recovery Architecture

- **Master/Slave hot backup with the automatic disaster recovery:**
  - Node statuses are monitored via heartbeat messages in the cluster.
  - A new master node is automatically elected in the cluster when the original master node is unreachable.
  - A faulty master node becomes a slave node after recovering; or the cluster adds a new node if the faulty master node fails to recover.
  - When a node is unreachable, the system will attempt recover it. If the attempt fails, a new node is added.



3.1 TencentDB for MongoDB: Game Development

- Requirements: Game development requirements change constantly and the products iterate quickly, resulting in frequent database table structure changes.
- Solution: MongoDB does not have a fixed schema, significantly reducing the iteration cycle.



3.1 TencentDB for MongoDB Advantages

Aspect	TencentDB for MongoDB	Self-built MongoDB
Pricing	No software or hardware investment	High costs
Service availability	99.95%	Not guaranteed
Data reliability	99.9996%	Not guaranteed
System security	Anti-DDoS and bug fixes	Not guaranteed
Real-time monitoring	Multi-dimensional monitoring and fault warnings	Capabilities must be developed by the client.
Service capacity expansion	Expansion on demand	Pre-planned
Resource utilization	Resources are applied for as needed	Resources must meet peak demand, with low utilization at other times

3.2 TencentDB for Redis

TencentDB for Redis

- Provides elastic caching and storage services that are compatible with open-source Redis protocol.
- Supports various database services, including master/slave hot backup, automatic disaster recovery, data backup, failover, instance monitoring, online capacity expansion, and data rollback.

Engine	Description
Redis community engine	Compatible with Redis 2.8 and 4.0 protocols and commands
Tencent CKV engine	Compatible with Redis 3.2 protocols and commands

3.2 TencentDB for Redis

腾讯云

Storage Engine	Redis Community Engine	Tencent CKV Engine
Supported versions	**Standard and cluster versions**	**Standard and cluster versions**
Architecture	Single-thread	Multi-thread
QPS	80,000 to 100,000 for the standard version, and tens of millions for the cluster version	80,000 to 120,000 for the standard version, and tens of millions for the cluster version
Cold/Hot separation	Not supported	Not supported
MAR	Not supported	Not supported
Data backup	Backup via bgsave, requires double the memory	No extra memory required
Smooth upgrades	Supported in the cluster version	Supported
Fast startup	Slow	Within 1s, based on the in-memory shared data
Capacity per node	0.25 GB – 60 GB	4 GB – 384 GB

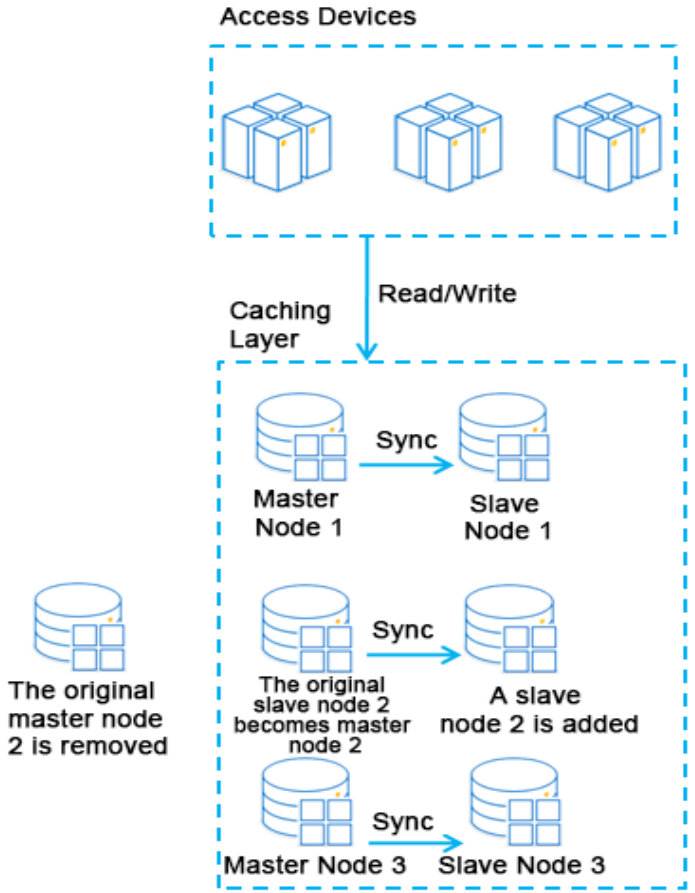
3.3 TencentDB for Memcached

TencentDB for Memcached

- Provides Memcached-compatible elastic caching and storage services. It is convenient, high performance, and reliable.
- Supports various database services, including master/slave hot backup, automatic disaster recovery, online capacity expansion, data backup, and instance monitoring.

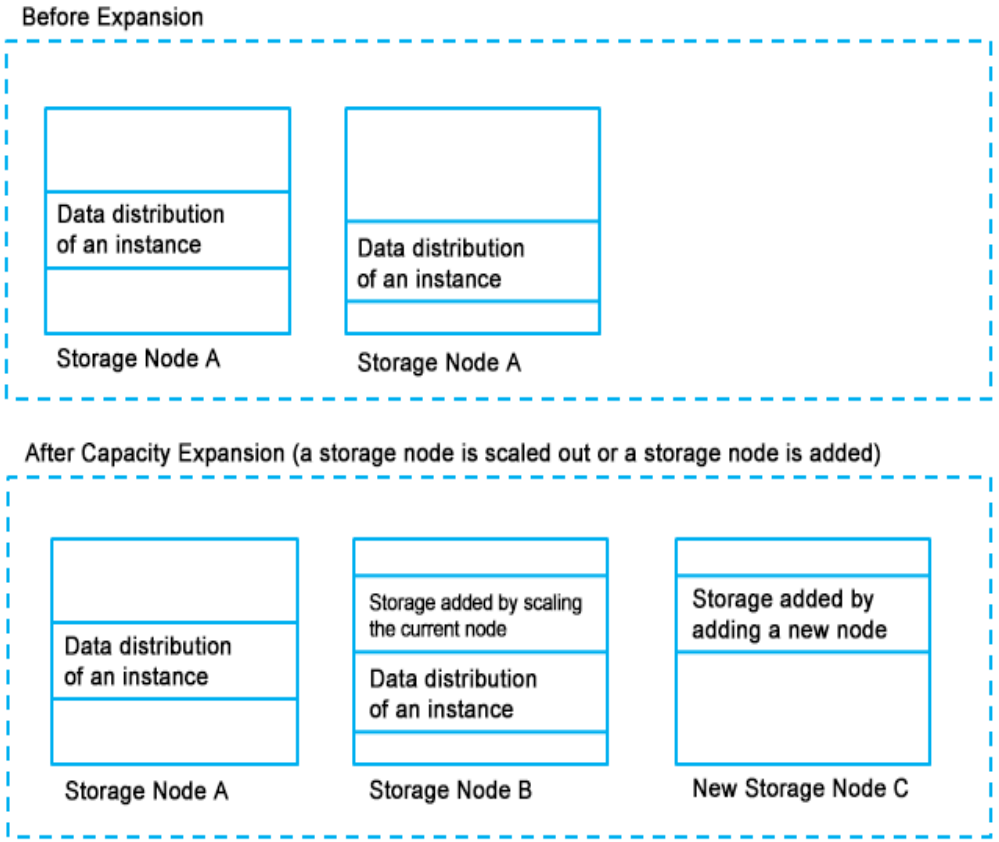
3.3 TencentDB for Memcached: Automatic Disaster Recovery

- Each instance is stored in multiple nodes to ensure master/slave hot backup.
- When a node encounters a fault, the system automatically switches to another node. This can also be done manually.
  - When the master node fails, the system switches to a slave node and that becomes the new master node. Subsequent Read/Write requests are sent to the new master node.
  - A slave node is added to synchronize data from the new master node.
  - When a slave node encounters a fault, a new slave node is added to take its place.

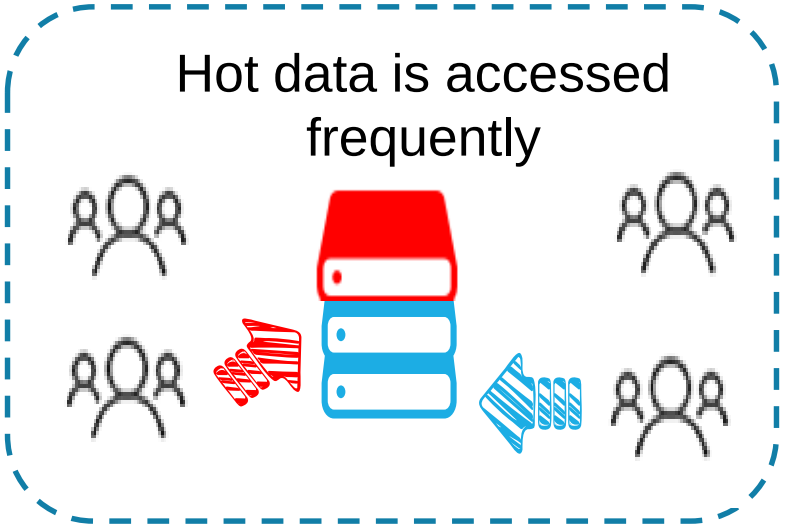


3.3 TencentDB for Memcached: Online Capacity Expansion

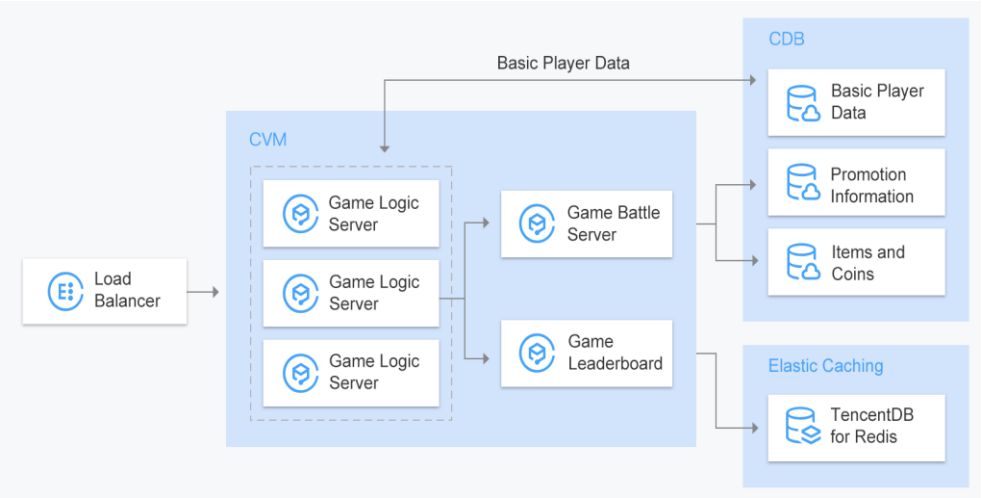
- Automatic capacity expansion ensures that a user instance always has 20% space available.
- **To expand the capacity of an instance:**
  - Check whether the free space of the current storage node meets the capacity expansion requirements.
  - If the requirements are met, expand the capacity of the node. Otherwise, add an additional storage node.

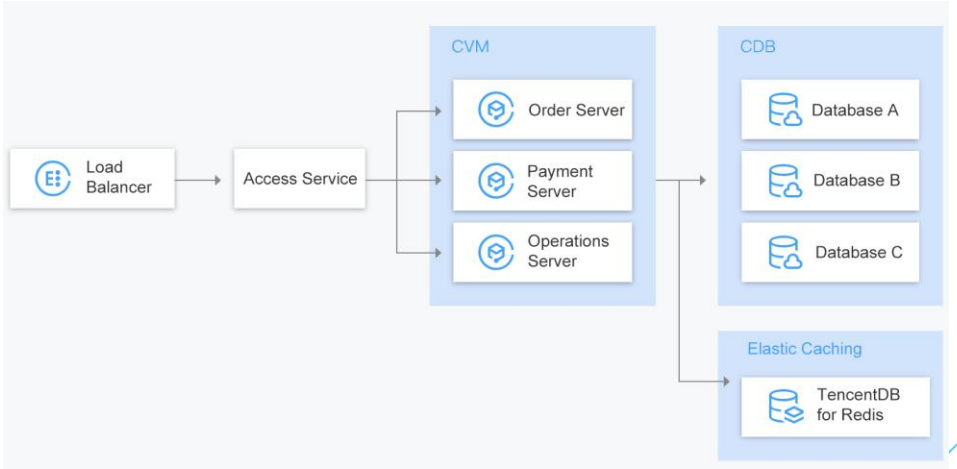


3.3 TencentDB for Redis/Memcached Use Cases



- **Stores hot data to for high-speed access:**
  - Gaming: Leaderboards
  - Internet/Applications: Hotspot access and data download
  - E-commerce: Commodity classification data, image and commodity search results





3.4 TencentDB for CTSDB

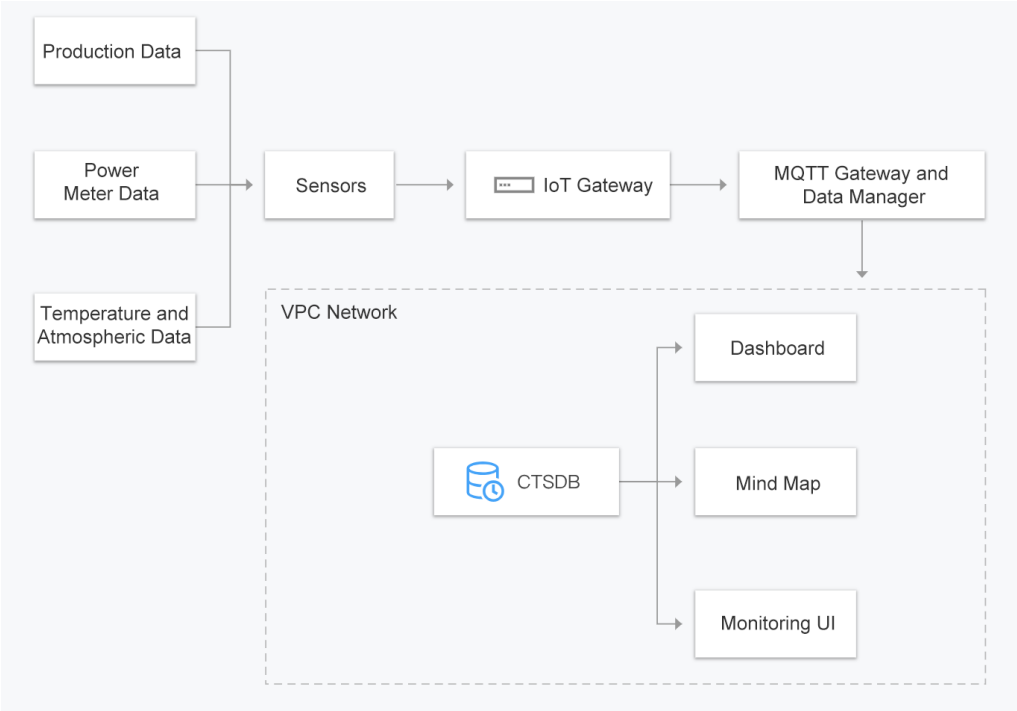
TencentDB for CTSDB

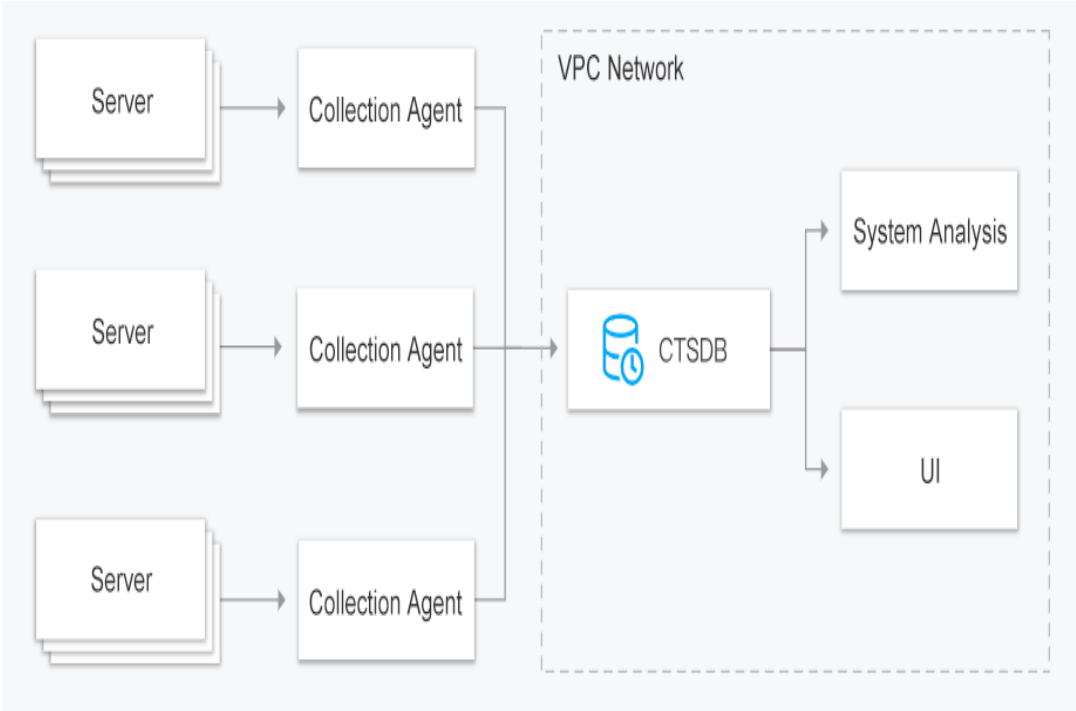
- **CTSDB** processes data containing timestamps (which change with time).
- **TencentDB for CTSDB** provides a secure, stable, and high-performance distributed time series database in the cloud.
  - High-concurrency Write: Writes to memory -> dump -> batch write
  - Low-cost storage: Rollup data aggregation and compression
  - Aggregation analysis: Provides a suite of aggregated query and analysis methods

- TencentDB for CTSDB supports petabytes of data, real-time writing, and fast query results.

3.4 TencentDB for CTSDB: IoT Monitoring

- **Internet service monitoring and analysis**
  - TencentDB for CTSDB generates log reports to facilitate analysis and troubleshooting.



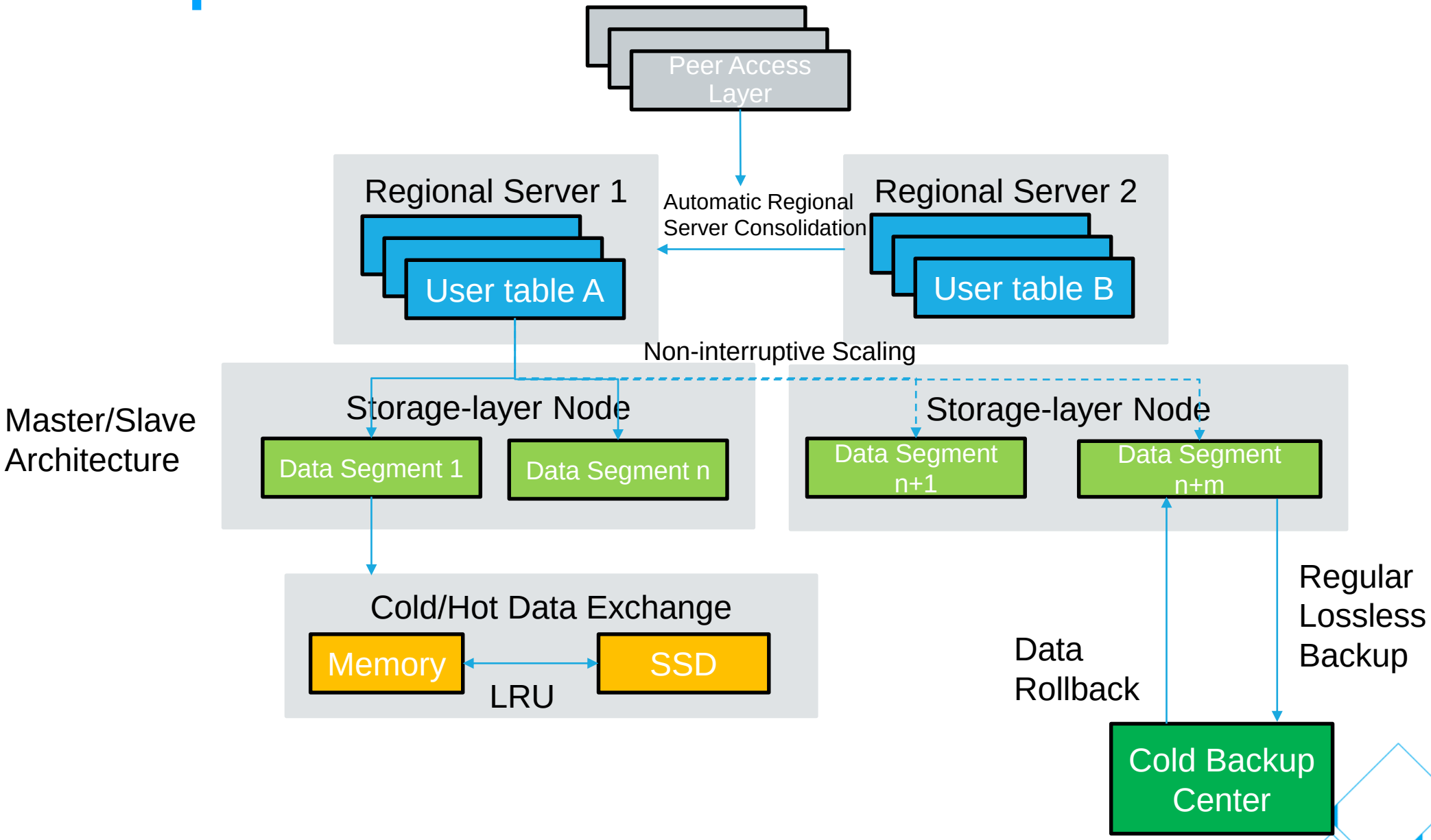


3.5 TcaplusDB

TcaplusDB

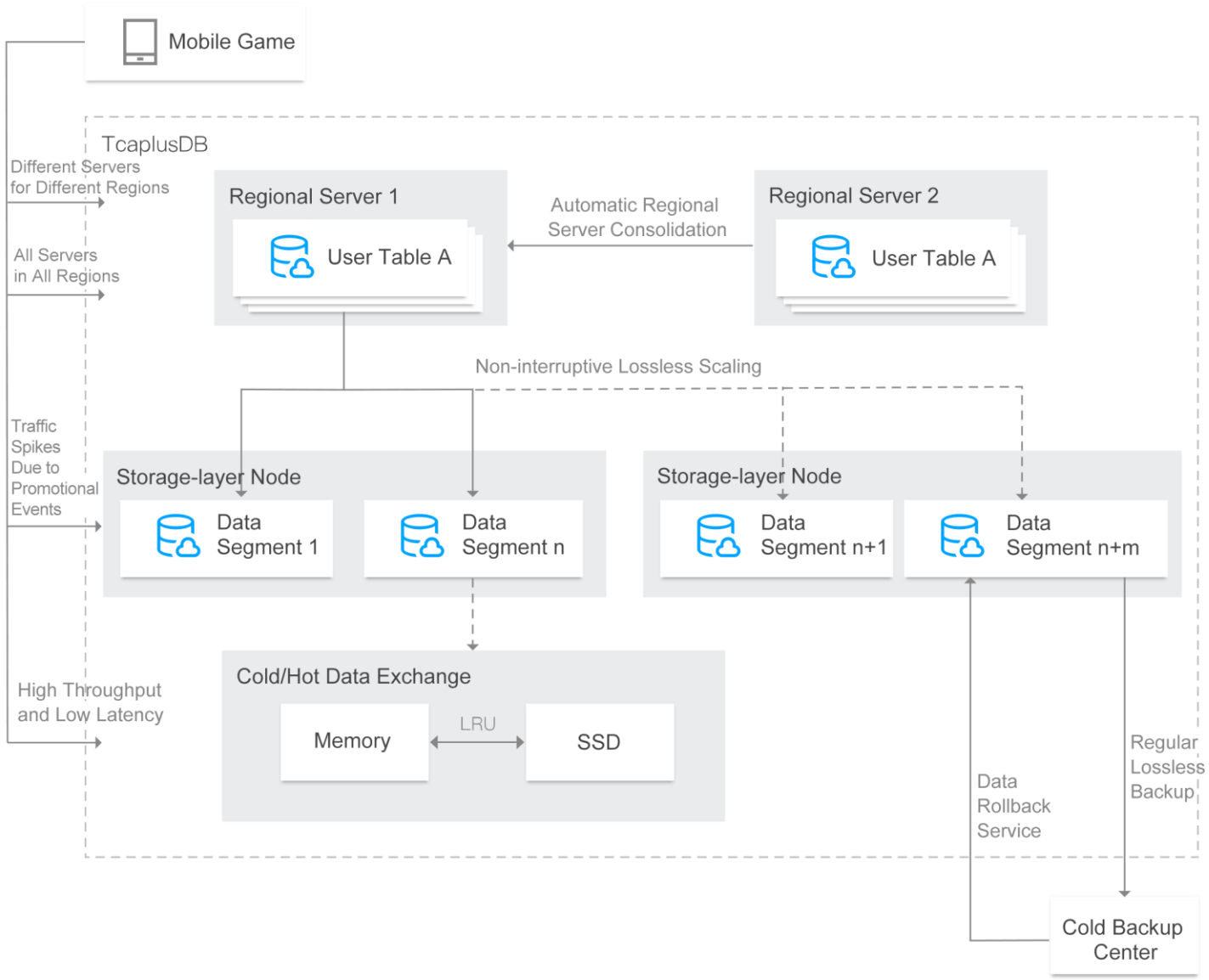
- Tencent Cloud Tcaplus Database (TcaplusDB) is a distributed NoSQL data storage service designed for games.
  - Supports caching and persistent storage, with up to 100,000 QPS per device.
  - Available on all servers in all regions, with each table supporting up to 50 TB of data.
  - Supports Protobuf access.
  - Provides fast rollback and disaster recovery.

3.5.1 TcaplusDB Architecture



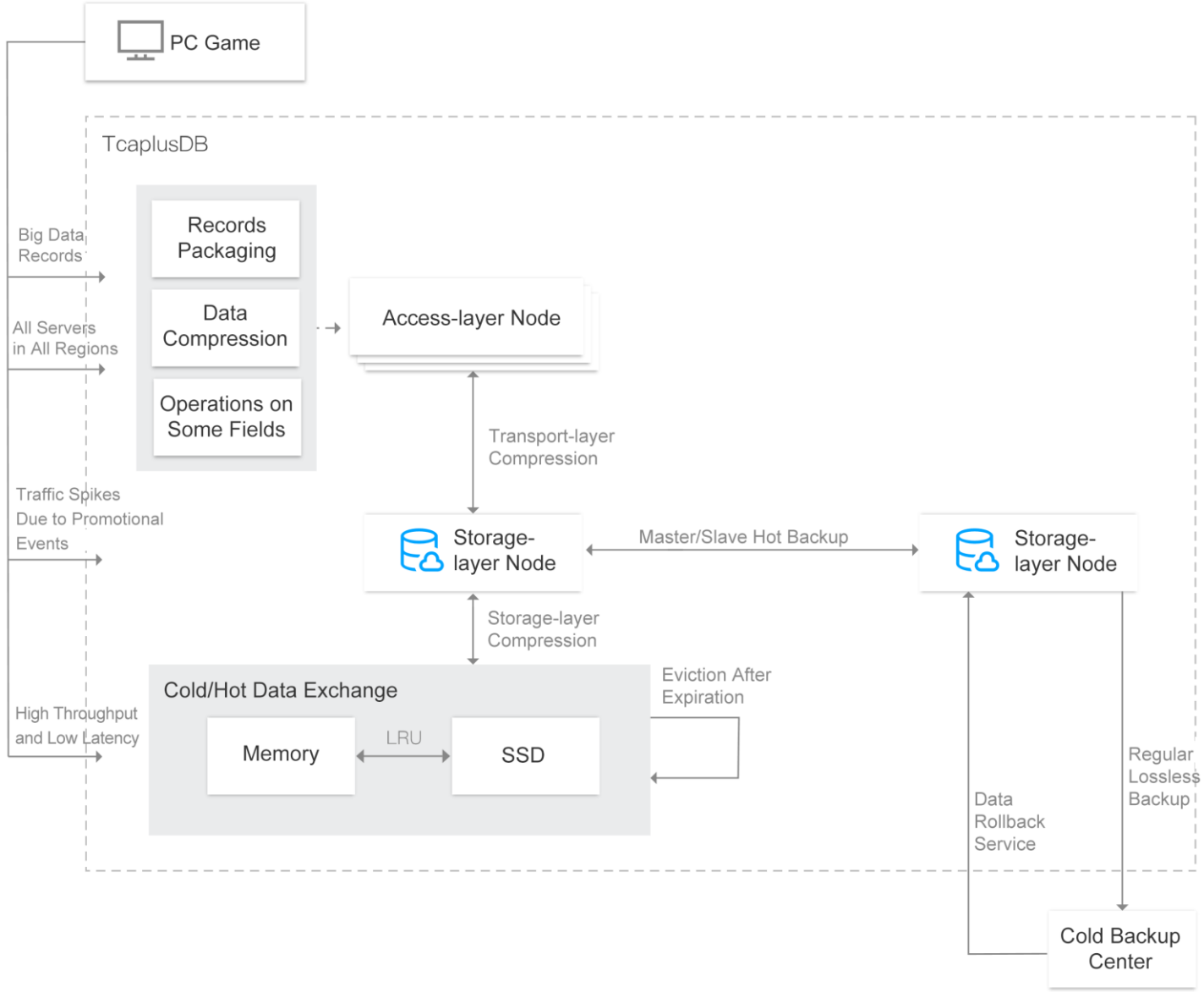
3.5.2 TcaplusDB: Mobile Gaming

- **Mobile gaming characteristics:**
  - Fragmented play time
  - Frequent player interactions
  - Huge data volumes
- **TcaplusDB**
  - Non-interruptive lossless scaling
  - Distributed cold/hot data exchange
  - Automatic regional server consolidation



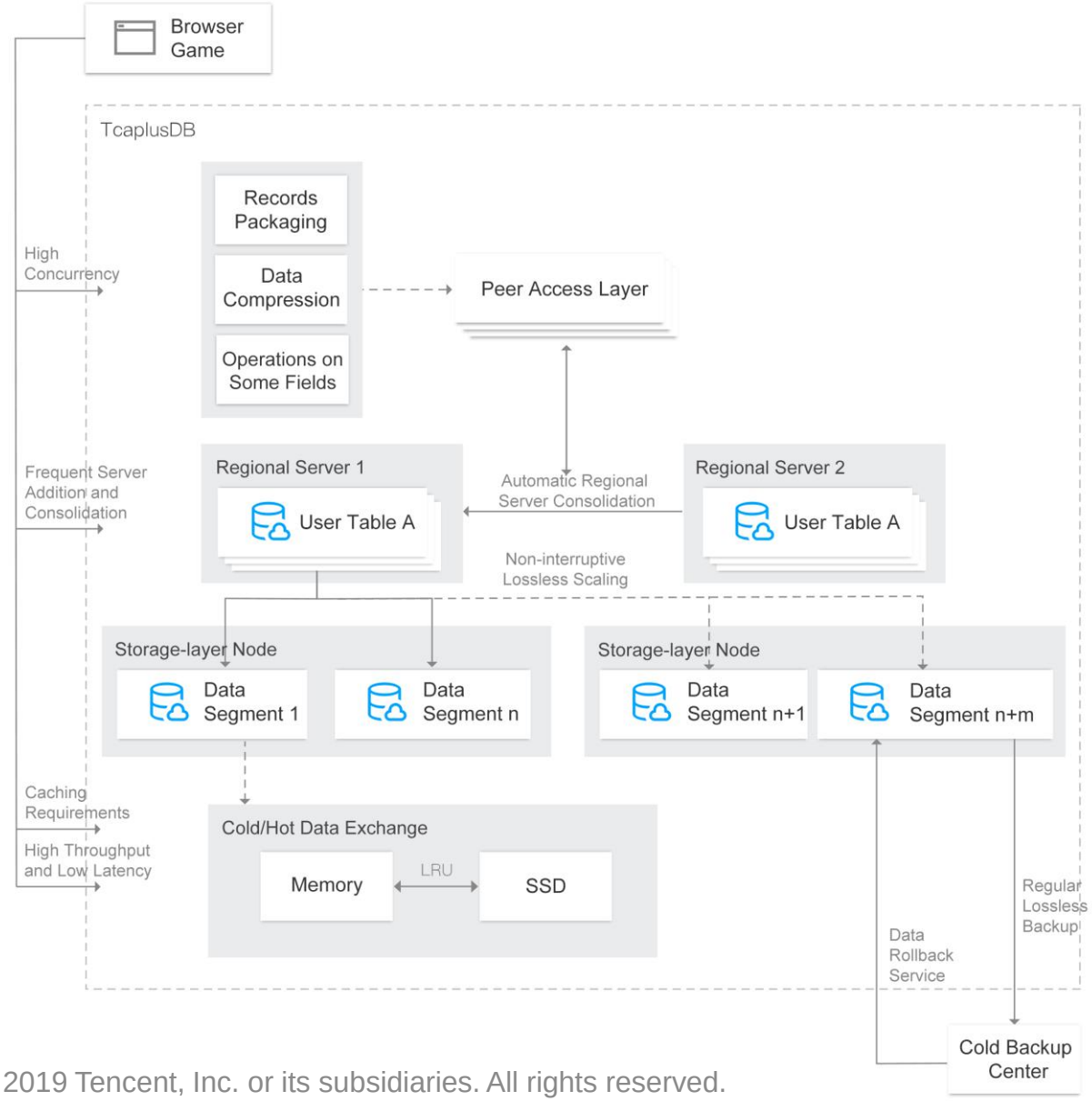
3.5.2 TcaplusDB: PC Gaming

- **PC gaming characteristics:**
  - Long playing time
  - Huge data volumes
- **TcaplusDB**
  - Data compression and eviction
  - Automatic record packaging
  - Distributed cold/ hot data exchange
  - Automatic backup and rollback on demand



3.5.2 TcaplusDB: Browser Gaming

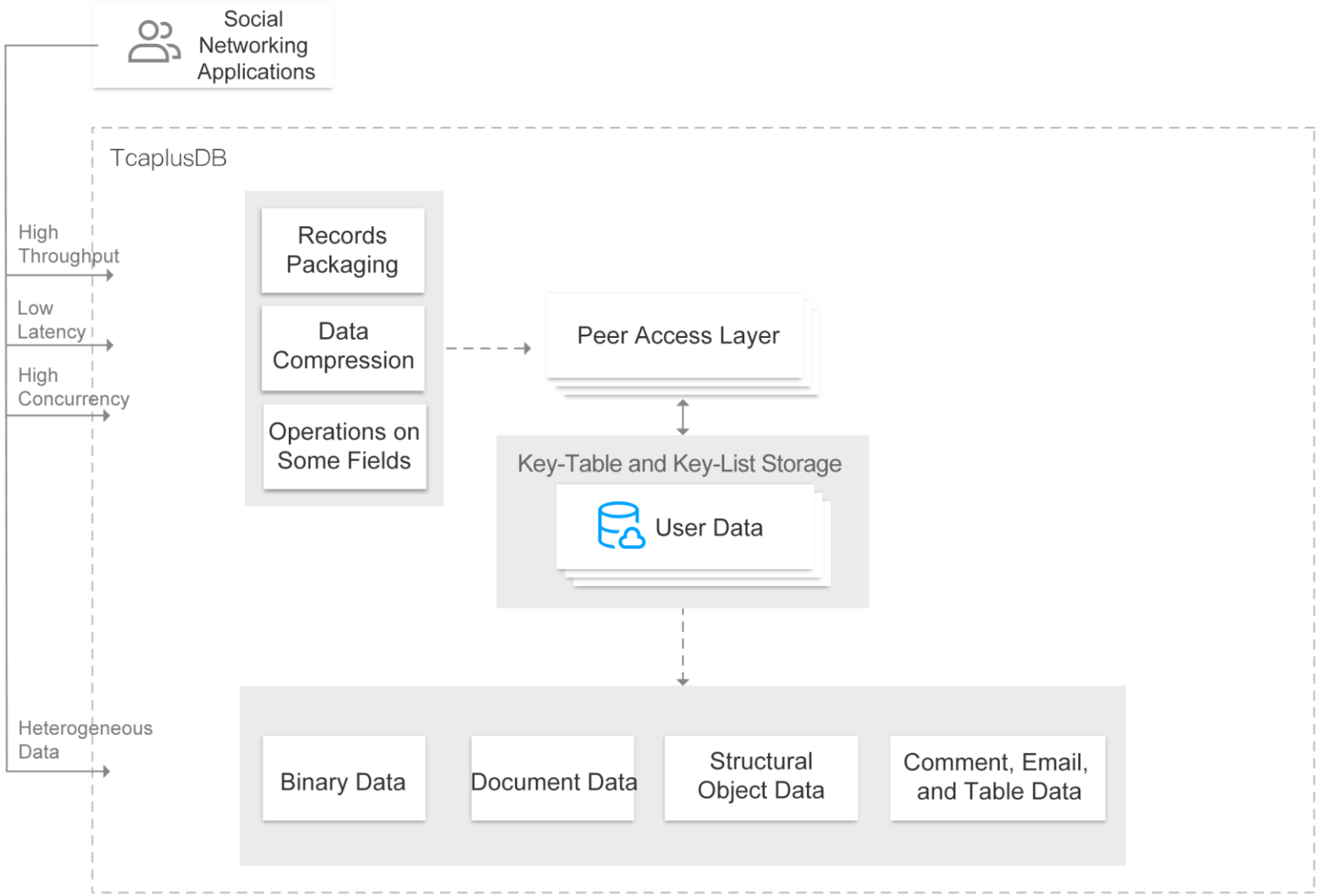
- **Browser gaming characteristics:**
  - Weak caching capability
  - 24/7 service
  - Frequent server addition and consolidation
- **TcaplusDB**
  - Caching and high-speed disks
  - Automatic server consolidation
  - Lossless scaling



3.5.2 TcaplusDB: Social Networking

- **Social networking characteristics:**
  - Free data creation
  - Frequent commenting and messaging
  - Write Rarely, Read Mostly

- **TcaplusDB**
  - Stores data in tables
  - Supports heterogeneous data
  - Cold/Hot data exchange
  - Read/Write separation



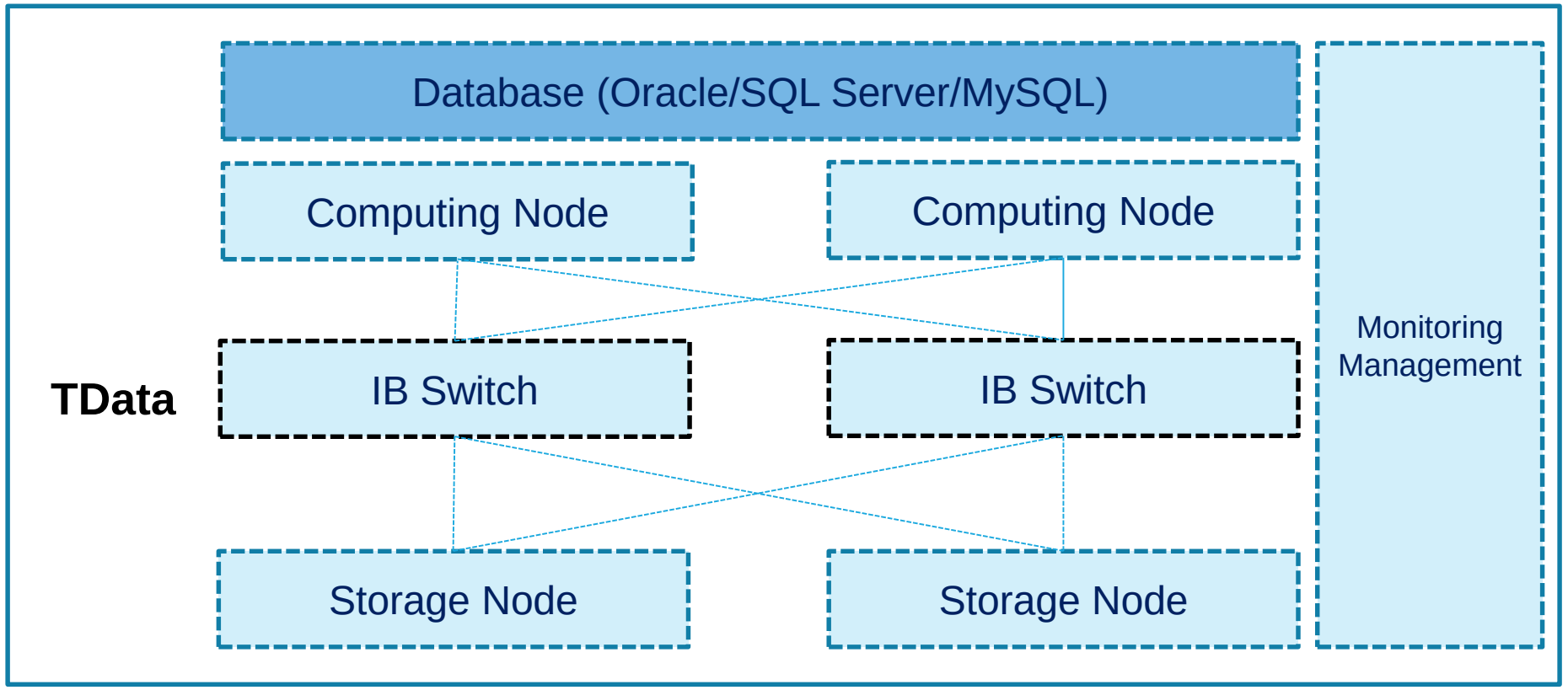
腾讯云

CONTENTS

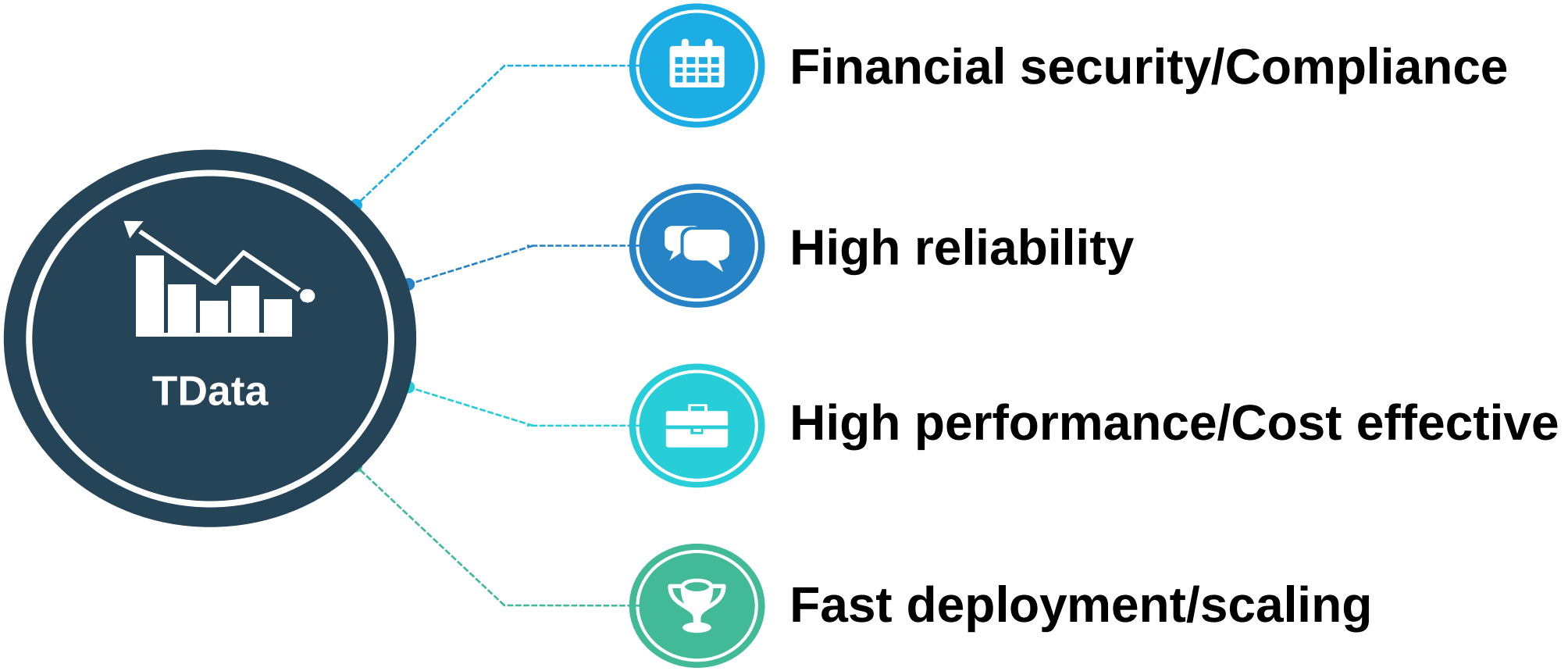
Chapter 4 TencentDB Services

4.1 All-in-One Database: TData

- TData is an all-in-one database solution that integrates high-performance computing, hot-swap storage, and InfiniBand networks.

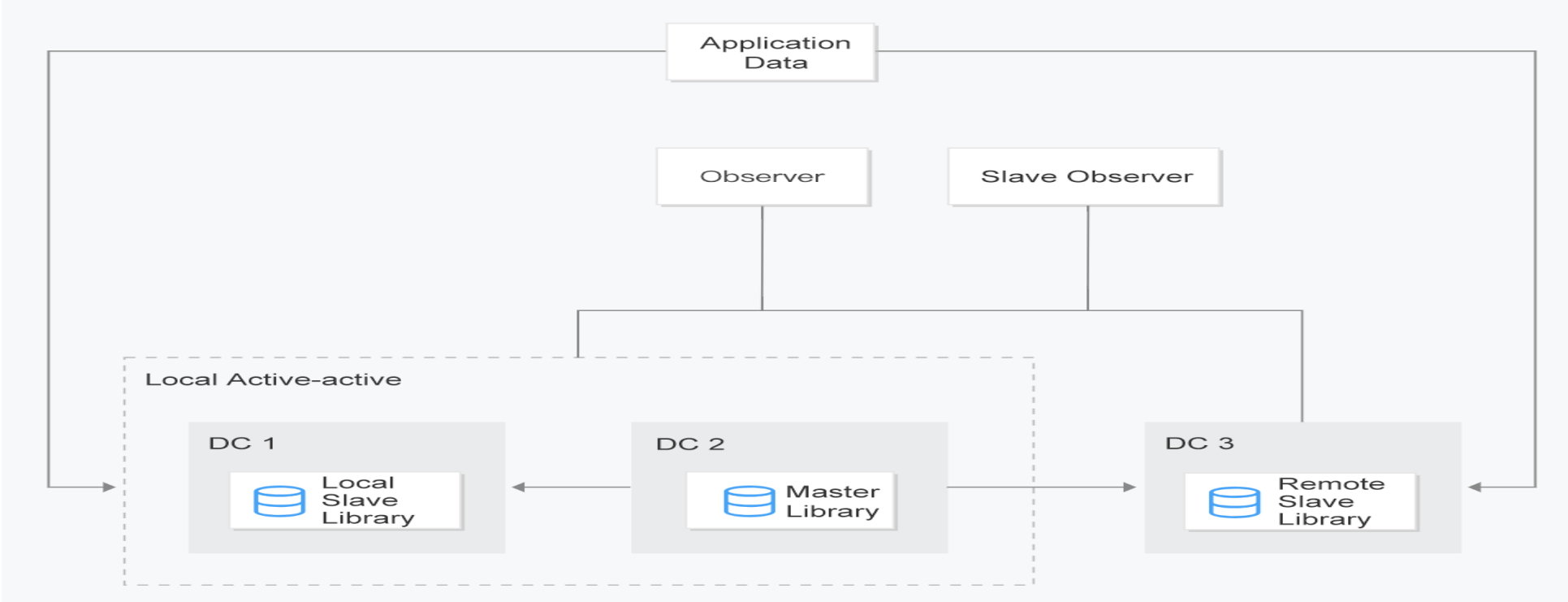


4.1 TData Advantages



4.1 TData Use Cases

- Meets the requirements of OLAP, OLTP, and hybrid load
- 2 Regions + 3 DCs setup: intra-city active-active capabilities and remote disaster recovery to meet the stringent availability requirements for industries such as finance



4.2 Data Transfer Service (DTS)

- Tencent Cloud DTS provides integrated data transfer management services for databases.

Data migration

- Data Migration for different databases running in different environments

Data synchronization

- Real-time synchronization between instances of TencentDB for MySQL

Data subscription

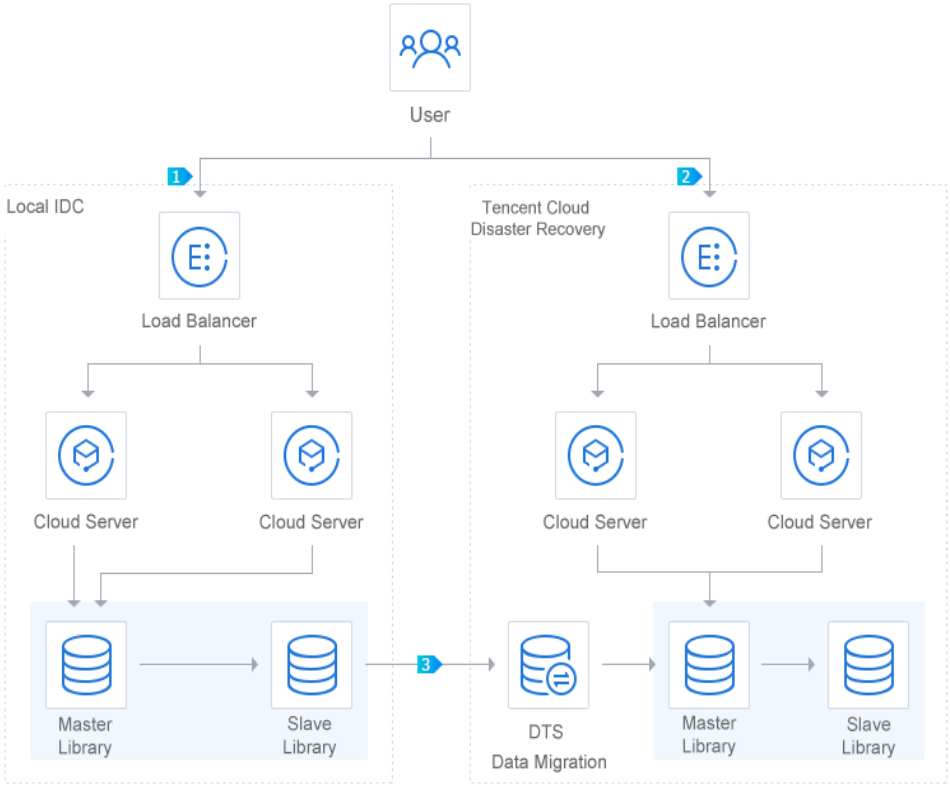
- Binlog-based real-time synchronization of incremental updates to the database

4.2 DTS Requirements

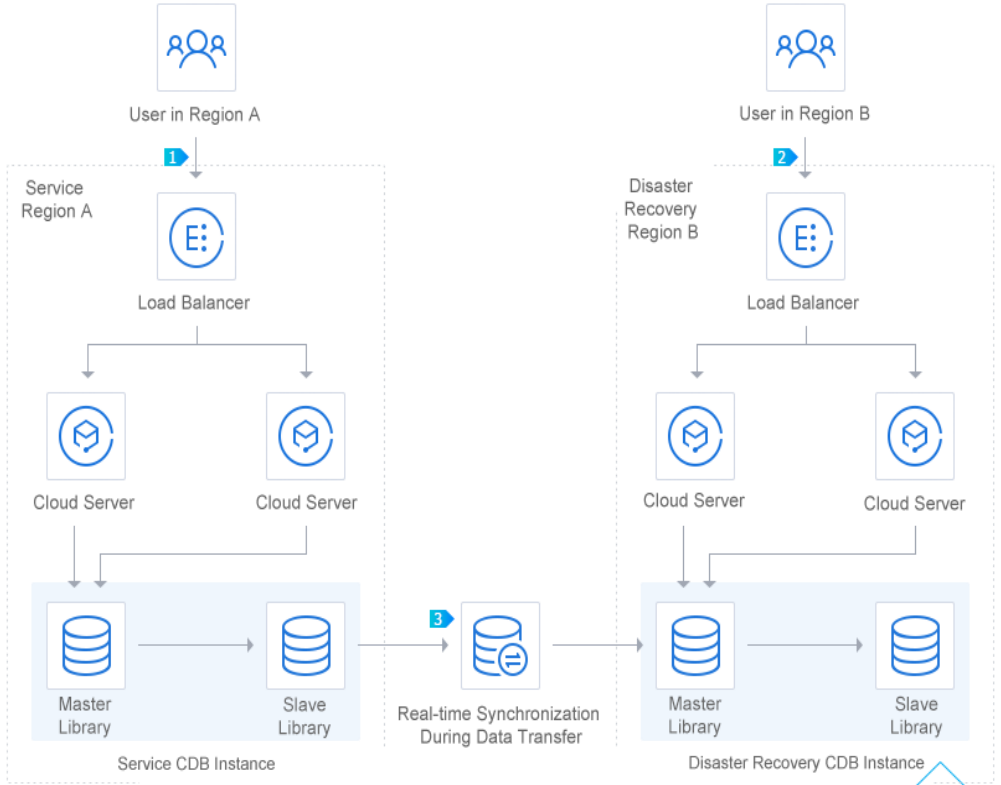
- Source database types:
  - MySQL, Redis, MariaDB, PostgreSQL, and Percona
- Access types:
  - Public network, Direct Connect, VPN, CCN, TencentDB, and CVM
- Target databases:
  - Target database should be the same type as that of the source database

4.2 DTS: Database Disaster Recovery

- Local database disaster recovery



- Cloud database disaster recovery



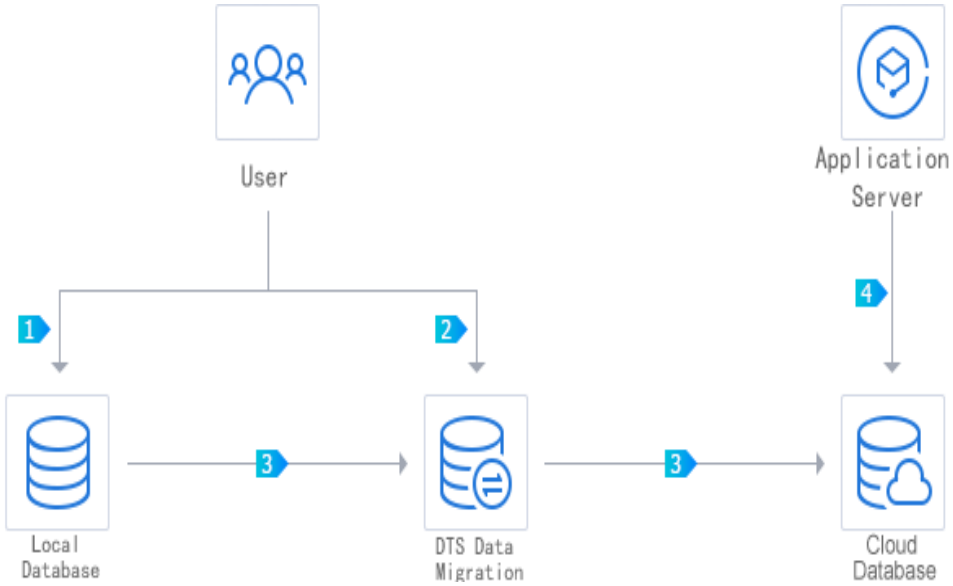
4.2 DTS: Cloud Migration and Archiving

- Migrating Data onto Cloud
  - Local export
  - Cloud import
  - Incremental updates and data replication

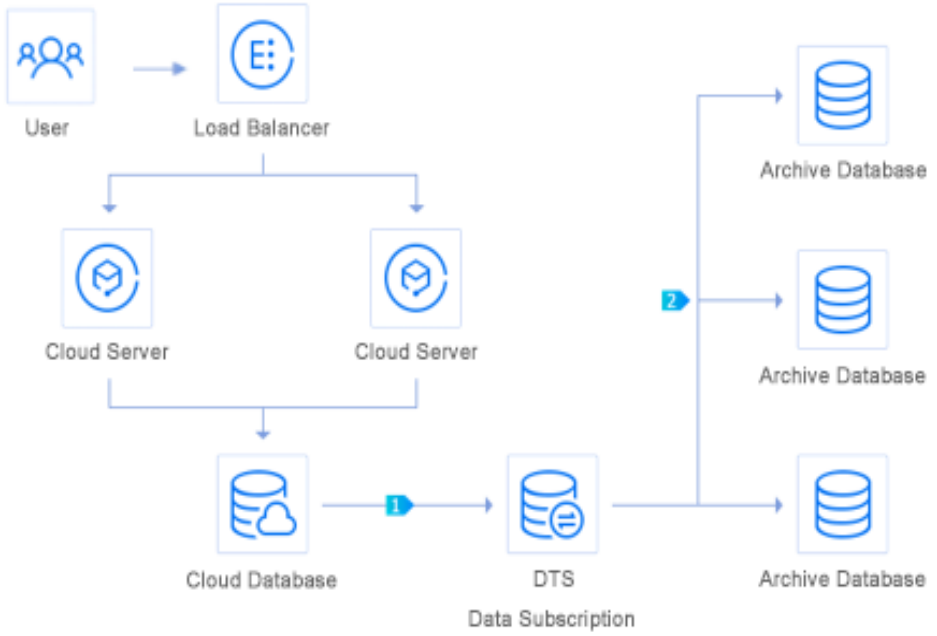
- Complex operations
- Heavy workloads

4.2 DTS: Cloud Migration and Archiving

- **Migrating Data onto Cloud**



- **Data archiving**



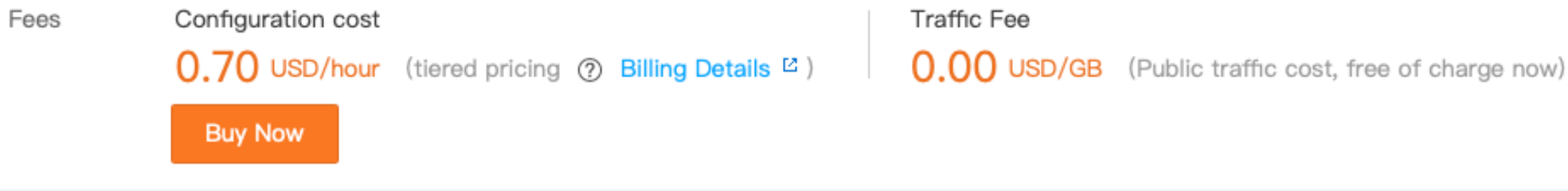
4.2 DTS Advantages

- Hot migration between databases
- Compatible with multiple network environments
- Incremental updates of subscription data
- Data migration
- Data synchronization
- Data subscription

Chapter 5 TencentDB Products Billing Modes

CONTENTS

5.1 TencentDB for MySQL & PostgreSQL Biling Mode



Instance price formula: Instance price=Memory specification fee+Storage fee.

For the renewal and upgrade of instances with the original specification, refer to the new billing system.

In addition, tiered pricing is available for pay-as-you-go instances, providing a more cost-effective option for long-term use.

For more pricing information about TencentDB for MySQL, see here .

For more pricing information about the TencentDB for PostgreSQL, see here.

5.2 TencentDB for MongoDB Billing Mode

Billing Details

Total price of an instance=Number of shards x Number of nodes in each shard x Price of one node.

Billing is pay-as-you-go, which is a postpay billing method. When you create a document database, we will freeze the hardware cost of one hour in your Tencent Cloud account and charge the usage fee on the dot of each hour (Beijing time). The billing time is accurate down to the second. With the pay-as-you-go billing method, you only need to pay for what you use, and no upfront payment is required.

Pay-as-you-go pricing includes 3 pricing tiers. The first tier is the initial purchase price. After a certain period of consistent usage, the price will drop to the third tier, which is almost half the price of the first tier.

For more information about the pricing, see here.

5.3 TencentDB for Redis Billing Mode

Billing Method

- TencentDB for Redis uses a linear pricing strategy, where the charges for an instance is calculated by multiplying the instance specifications by the unit price.
- It is pay-as-you-go.
- The billable usage time is accurate down to the second, where the unit price = monthly price / 30 days / 24 hours / 3600 seconds.

Pay-as-you-go

TencentDB for Redis supports tiered pricing. The longer it is used, the cheaper it is. Depending on the usage duration, the prices in pay-as-you-go mode are divided into three tiers:

- 0 days < duration ≤ 4 days: Tier 1 pay-as-you-go pricing is used, where hourly price = monthly price / 30 / 24 * 2
- 4 days < duration ≤ 15 days: Tier 2 pay-as-you-go pricing is used, where hourly price = monthly price / 30 / 24 * 1.5
- Duration > 15 days: Tier 3 pay-as-you-go pricing is used, where hourly price = monthly price / 30 / 24

For more information about the pricing, see here.

5.4 TcaplusDB Billing Mode

Billing Method

Daily cost of TcaplusDB = Daily capacity fees + Daily fees for reserved writes + Daily fees for reserved reads

Settlement Cycle

Fees are charged on a daily basis, and those generated in the current day will automatically be deducted on next day. The fees of the previous day will be deducted daily at 00:00. Any bill-related dispute should be resolved through negotiation. When negotiation fails, the resolution shall be based on the system data.

For more information about the pricing, see here.

Summary

- This course covered the following topics:
  - Basic database knowledge: The difference between SQL and NoSQL databases, mainstream NoSQL databases, and database trends
  - TencentDB for relational databases: MySQL, SQL Server, PostgreSQL, MariaDB/TDSQL, and CynosDB
  - TencentDB for non-relational databases: MongoDB, Redis/Memcached, CTSDB, and TcaplusDB
  - TencentDB services: TData and DTS
  - TencentDB products Billing Modes

Thank you