05 Introduction to Tencent Cloud Storage Products

Course Objectives

- At the end of this course, you will have a better understanding of:
  - The basics and types of storage technology
  - The features, principles, and advantages of Tencent Cloud storage products
  - The billing plans of Tencent Cloud storage products

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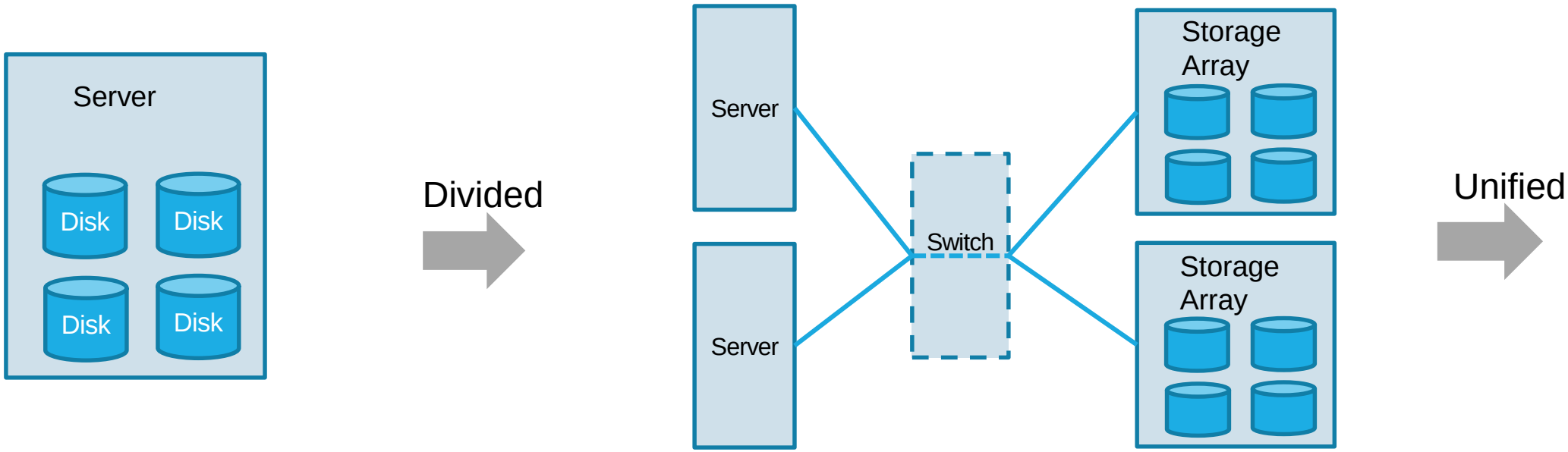
Chapter 1 Cloud Storage Basics

1.1 Brief History of Storage Technology

- Storage architecture evolution

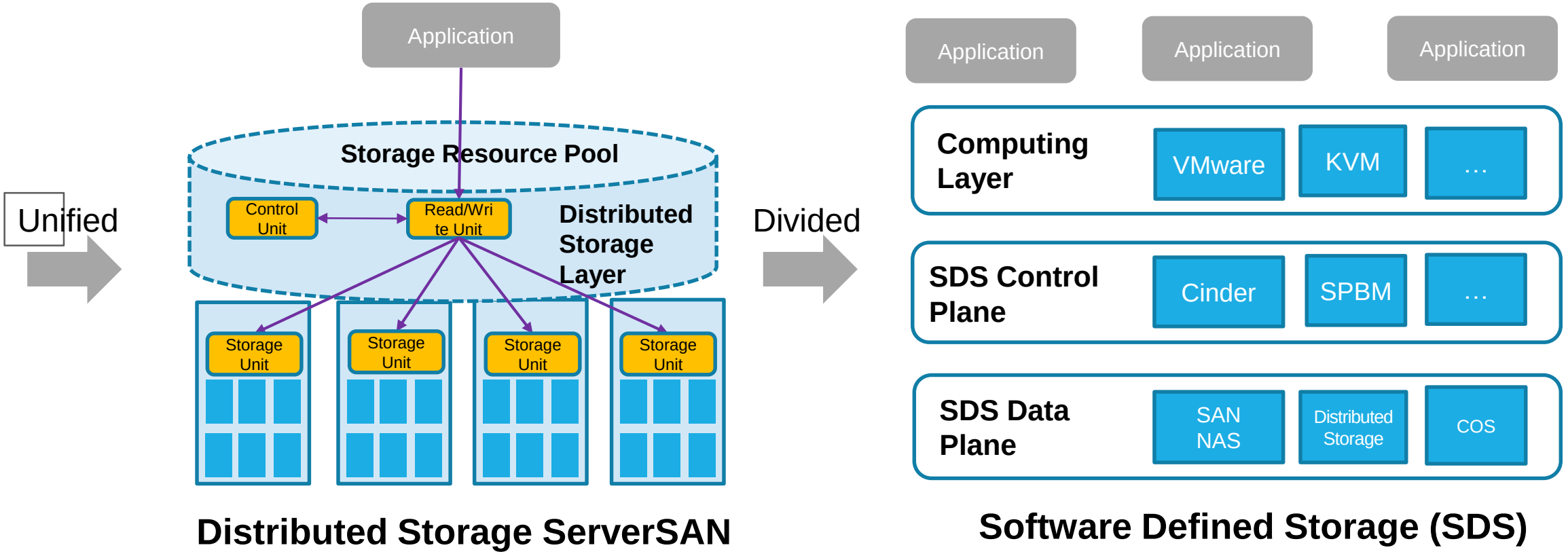


Direct-Attached Storage (DAS)

Storage Area Network (SAN)

1.1 Brief History of Storage Technology (continued)

- Storage architecture evolution

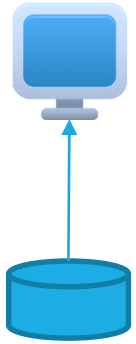


Distributed Storage ServerSAN

Software Defined Storage (SDS)

1.2 Storage Types

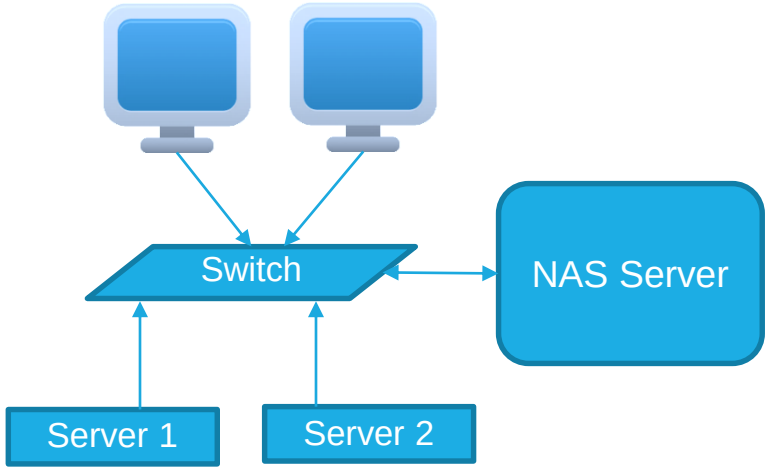
Block Storage



Advantages:
1. Low costs
2. Parallel write and SAN networking, which improve transmission speed and Read/Write efficiency.

Disadvantages:
1. Hardware investment
2. Data sharing
3. Cross-system sharing

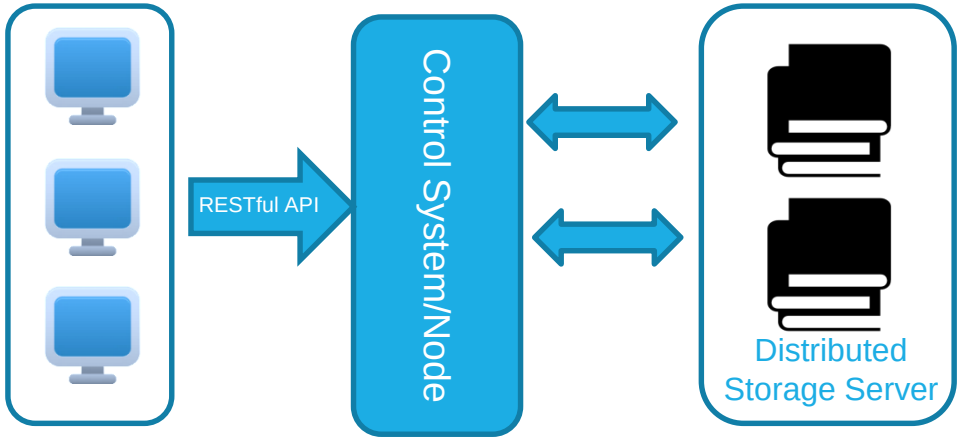
File Storage



Advantages:
1. Low costs
2. Convenient file sharing

Disadvantages:
1. Low Read and Write speed
2. Slow transmission speed

Object Storage



Object storage combines the high-speed direct access to disks of SAN and the distributed sharing of NAS.

1.3 Storage Media

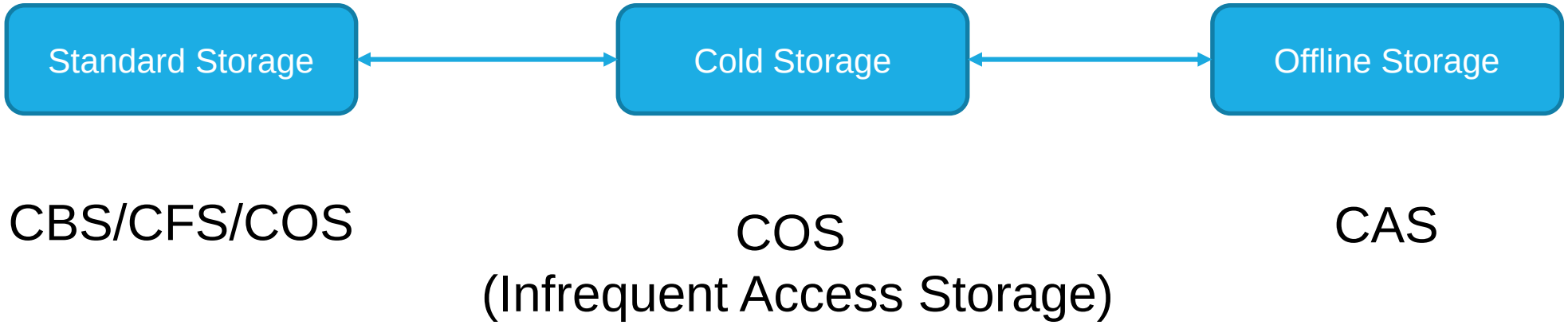
Media	Hard Disk Drive	Solid State Disk
How it works	The disc rotates and the head reads and writes data	The master reads and writes concurrently using logical block addressing (LBA)
Performance	Read: 200 MB/s; Write: 100 Mb/s	Read: 500 MB/s; Write: 200 MB/s
Maximum capacity	16 TB	4 TB
Number of writes	Unlimited	SLC master 100,000 MLC master 10,000
Power consumption and noise	Driven by a high-power motor, HDDs have high power consumption and generate noise and heat	SSDs feature low power consumption, a standby feature, low noise, and no heat
Shock resistance	The high-speed running head is susceptible to shocks	SSD chip storage is highly resistant to shocks
Data recovery	Data can be recovered by software after deletion	Data cannot be recovered after deletion
Price	Low	High

HDD

SSD

1.4 Storage Tiering

- **Storage tiering:** Data is stored on different storage devices according to access frequency, performance requirements, and cost considerations. Data can be automatically migrated among different storage tiers.
  - Locality of storage access
  - The cost performance of the storage solutions



1.4 Storage Tiering

Storage Tiering	Standard Storage	Cold Storage	Archive Storage
Data persistence	99.999999999%	99.999999999%	99.999999999%
Service availability	99.95%	99.9%	99.9%
Response time	Milliseconds	Milliseconds	Must apply for recovery in advance
Minimum billing time	-	30 days	90 days
Supported regions	All regions	All regions	All regions
Storage cost	Standard	Low	Very low
Data retrieval fee	-	Low	High
Read and write request fees	Very low	Low	Very low (must be recovered before read/write requests can be sent)

1.4 Storage Tiering

Tier	Description	Use Cases
Standard Storage	For hot data accessed at high frequencies and speeds. Provides high availability, high performance, and high throughput	Popular videos, social media photos, mobile apps, game apps, and dynamic websites
Cold Storage	For cold data accessed less frequently. Provides high reliability and cost-effectiveness	Cloud storage, big data analysis, government and business data, monitoring data
Archive Storage	For large amounts of data rarely accessed. Provides high capacity at low cost	Archives, medical imaging, scientific data, audio and video assets

1.5 Cloud Storage vs. Traditional Storage

Traditional Storage

For high-performance computing, transaction processing, and other applications

Functional requirements

Cloud Storage

Online storage services for various network types

Traditional Storage

Concurrent read and write limited by the performance of a single device

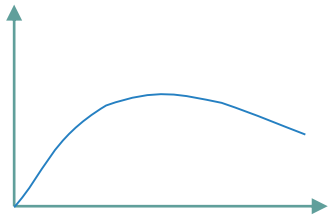
Performance requirements

Cloud Storage

- Control system isolated from data system
- Throughput affected by network conditions
- Theoretically unlimited bandwidth
- Multiple storage nodes provide concurrent access
- Load balancing for hot data

Traditional Storage

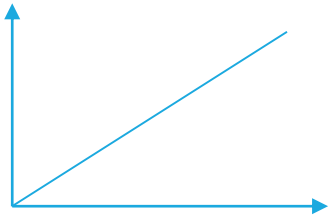
Limited maximum capacity, difficult to expand, high costs



Capacity expansion

Cloud Storage

Unlimited capacity, elastic scaling, linear performance



- Performance
- Security
- Reliability
- Cost effectiveness

Traditional Storage

Does not support the aggregated sharing of capacity and bandwidth among multiple devices

Data Sharing

Cloud Storage

Cluster file system supports flexible data sharing and centralized management

1.6 Tencent Cloud Storage Services

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Cloud Storage Products

Cloud Block Storage (CBS)

Cloud File Storage (CFS)

Cloud Object Storage (COS)

Cloud Archive Storage (CAS)

Cloud Storage Services

Cloud Storage Gateway (CSG)

Cloud Data Migration (CDM)

Cloud Log Service (CLS)

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Chapter 2 Tencent Cloud Storage Products

2.1 Cloud Block Storage (CBS)

CBS

CBS is a persistent block-level storage service for CVM instances on Tencent Cloud. CBS data is stored in availability zones with multiple replicas to avoid the risk of a single point of failure.

Features

- **3 disk options**
- **Elastic attach/ detach**
- **Auto scaling**
- **Snapshots**

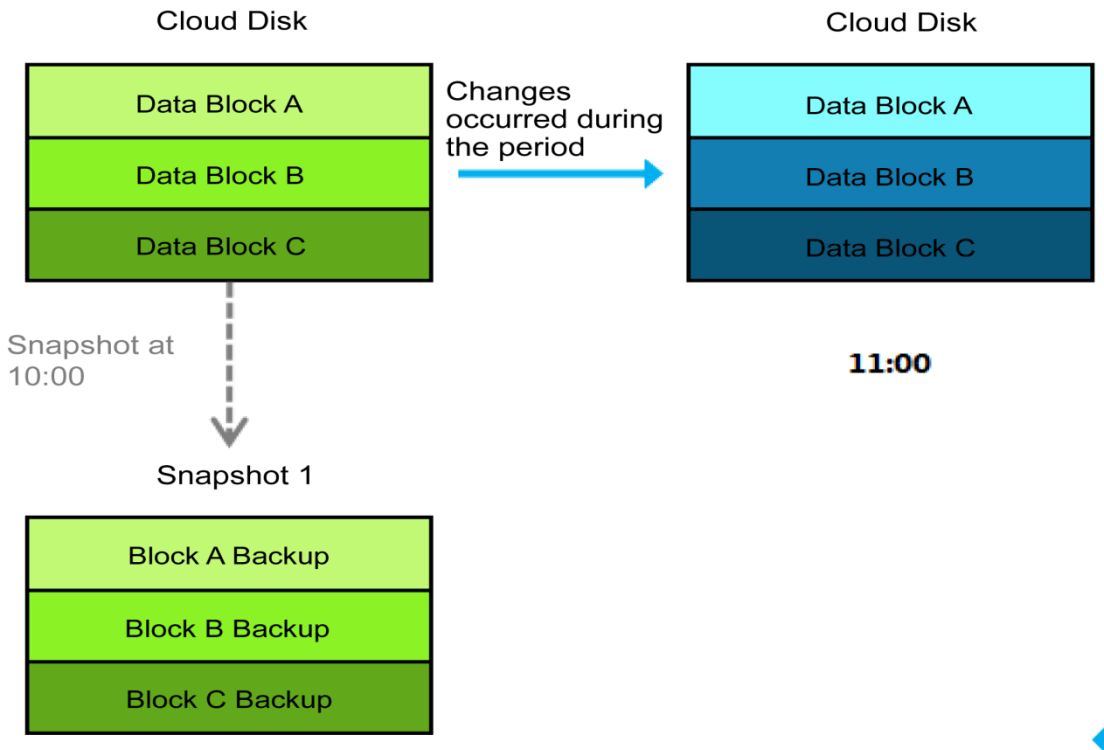
2.1 CBS Types

Types	HDD Cloud Storage	Premium Cloud Storage	SSD
Description	Low-cost HDD volumes for regular workloads	Mixed media volumes for core workloads that balance price and performance	SSD volumes for latency-sensitive transactional workloads
Use cases	Big data, data warehouse, log processing	Business logic processing, low-latency applications	Relational databases and NoSQL databases
Data persistence	0.99999999	0.99999999	0.99999999
Disk size	10 GB – 16 TB	50 GB – 4 TB	100 GB – 4 TB
Single disk maximum IOPS	1000	4500	24000
Single disk maximum throughput	100 MB/s	130 MB/s	260 MB/s
Access latency	Less than 10 ms	Less than 3 ms	Less than 3 ms

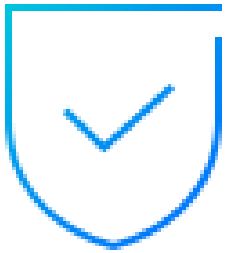
2.1 CBS Snapshots

- A snapshot is a backup of a cloud disk at a specific point in time. A snapshot can only be used in the region where the cloud disk resides. A snapshot is an incremental backup that only saves the changes since the previous snapshot.

- **Use Cases**
  - Daily backup of data
  - Fast data recovery
  - Applications that require multiple data replicas



2.1.1 CBS Advantages



Reliable

- Redundancy with three replicas
- Cross-rack storage

Elastic

- Elastic capacity configuration
- Scaling without business interruption

High performance

- High performance SSD
- 24,000 random IOPS on a single disk

Ease of use

- Easy to use
- Reduces deployment costs

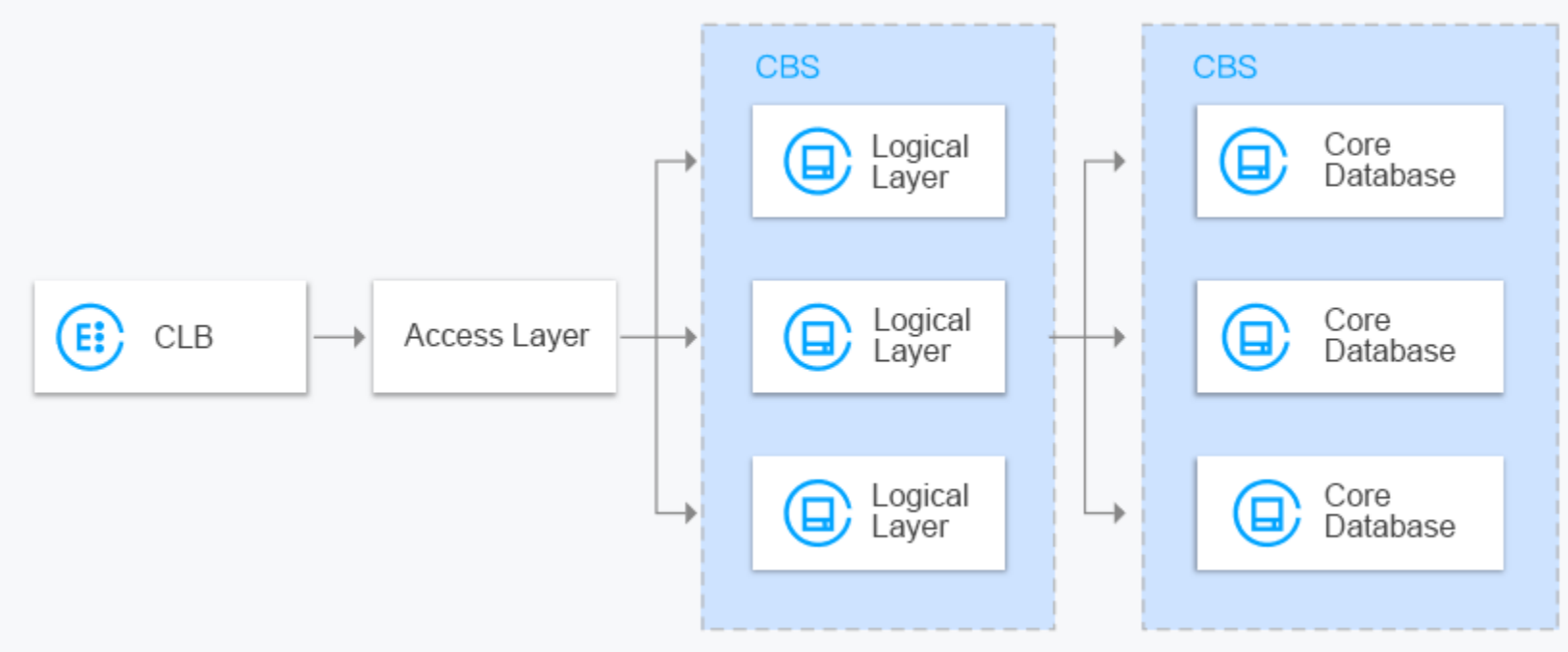
Snapshots

- Snapshot creation
- Snapshot-based instance creation

Enterprise office applications

2.1.2 CBS Use Cases

Analysis of massive data volumes



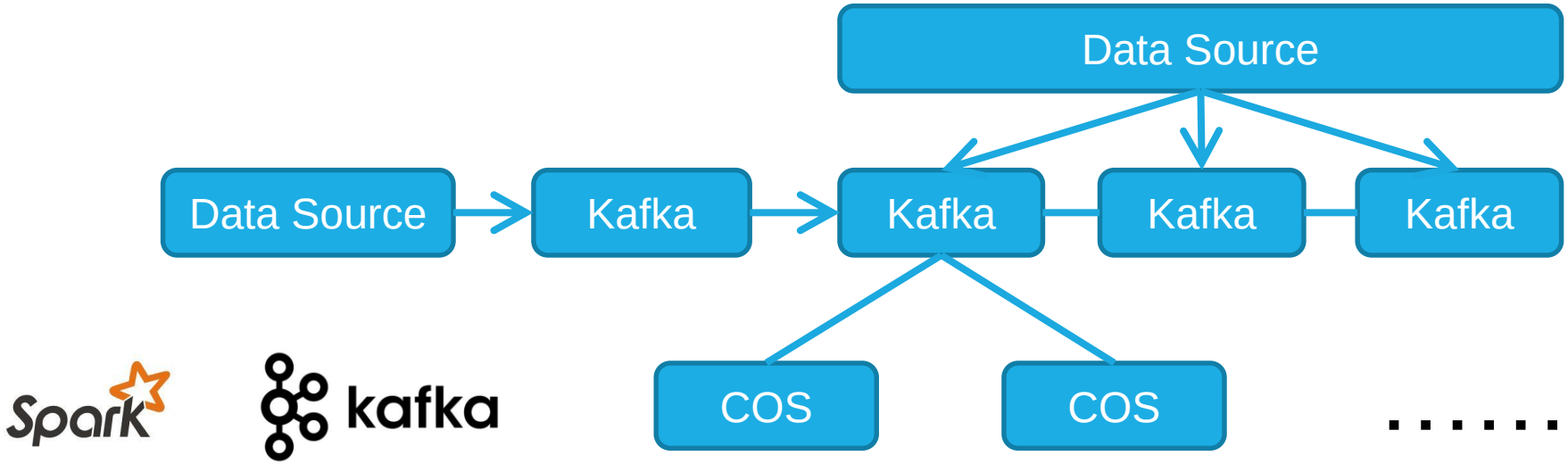
Example of CBS Application Architecture

2.1.2.1 Offline Big Data Analysis

- Use cases:
  - Hadoop large-scale offline data analysis
  - Data mining based on platforms with Hadoop + Hive + HBase cluster architectures
  - Business log cleansing, analysis, and information extraction
- Common properties:
  - Large data scale
  - Multi-disk concurrency
  - High disk performance requirements

2.1.2.1 Offline Big Data Analysis (continued)

- Typical use cases:
  - Xiaohongshu: Terabyte-scale offline data analysis cluster
  - Architecture: Kafka-Spark-HDFS offline data analysis framework
- Product used: Tencent Cloud Premium Cloud Storage

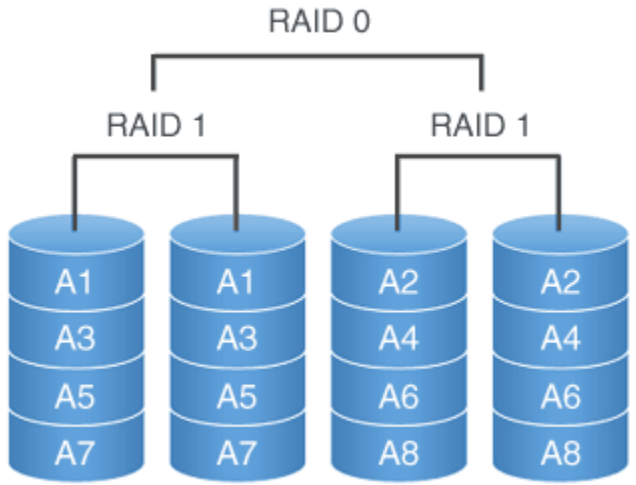


2.1.2 Offline Big Data Analysis (continued)

- Step 1: Kafka writes messages
  - Messages are written to the page cache, and the asynchronous thread concurrently flushes the disk, fully utilizing the concurrency of the cloud disk
  - When reading messages, the cloud disk intelligently pre-reads the data, which provides a direct hit for the sequential read. This translates into low latency and high throughput.
- Step 2: Spark reads and writes to the file system
  - RDD read/write and shuffle write use sequential I/O.
  - Shuffle read I/O uses random I/O.
  - Premium Cloud Storage provides sequential and random I/O capabilities comparable to SSDs.

2.1.2 Offline Big Data Analysis (continued)

- Tencent Cloud Premium Cloud Storage performance in a terabyte-scale offline data analysis use case
  - Premium Cloud Storage supports RAID10 configuration.
  - The performance of multiple disks can be combined to improve overall throughput.
  - With over 1 GB/s, it meets the requirements for terabyte-scale off data processing.



2.1.2 Online Transaction Processing

- Use case
  - Wendao, developer of Calibur of Spirit and other top games

- Business features
  - Peak traffic hours are usually at 19:00-22:00 and 03:00-05:00, which puts the storage system under a lot of pressure.
  - If disk performance cannot keep up, issues such as io wait, and high % uitl occur.
  - This causes lagging and/or disconnection.

2.1.2 Online Transaction Processing (continued)

- Configuration of Wendao’s environment
  - MySQL stress test environment:
    - ✓ 4-core 8 GB-RAM virtual machine
    - ✓ 800 GB SSD
    - ✓ MySQL 5.5.42
  - sysbench is used to gauge OLTP performance, and the test set contains 10 million records.
  - Results: TPS up to 1616 and QPS up to 29000

2.1.2 Online Transaction Processing (continued)

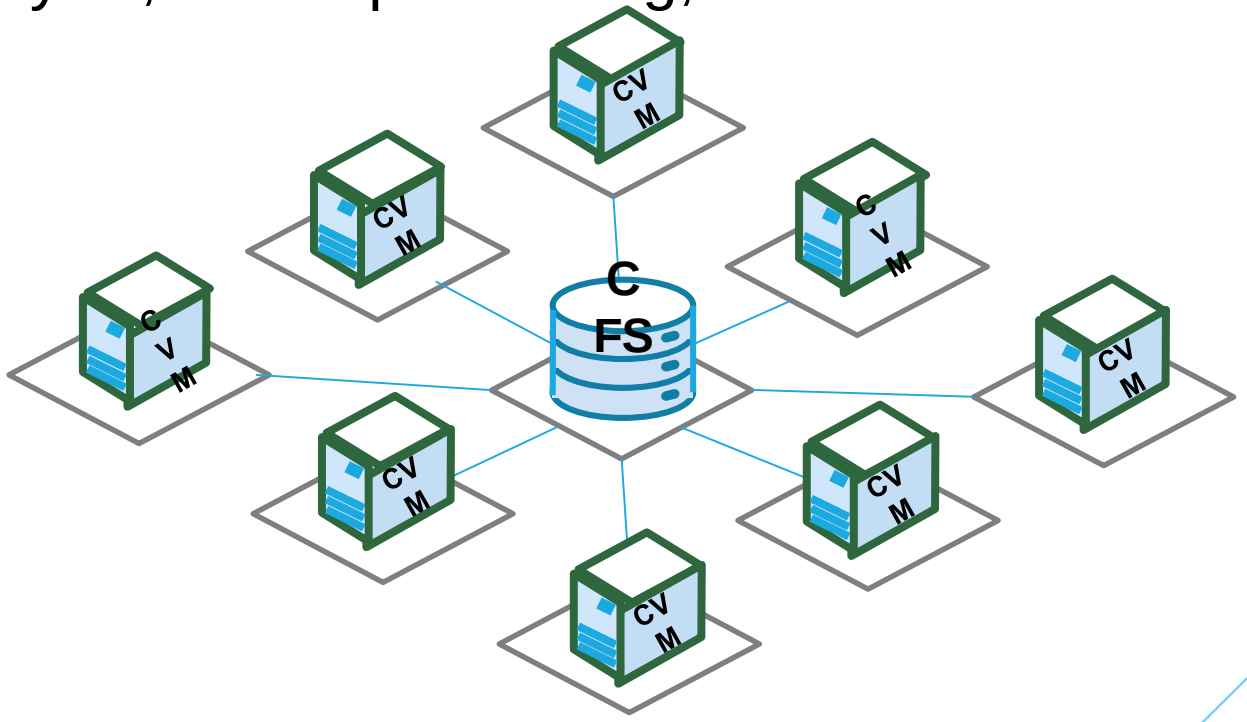
Conclusion

- A single SSD can support the I/O demand from 100,000 concurrent players.
- Premium Cloud Storage perfectly combines data reliability and high performance.

2.2 Cloud File Storage (CFS)

Cloud File Storage

- CFS can provide a shared data source for multiple CVM instances. It is a highly available, highly reliable distributed file system suitable for use cases such as big data analysis, media processing, and content management.
- Main features:
  - Centralized management
  - Auto scaling
  - Secure
  - Pay-as-you-go



2.2 Cloud File Storage (CFS) (continued)

	Cloud File Storage	NAS on CVM	Traditional NAS
Data reliability	99.999999%	99.999999%	85% - 99% (RAID)
Service availability	99.95% guaranteed, no risk of single point of failure	At risk of single point of failure or master/slave synchronization problems	At risk of single point of failure
Performance	Supports elastic scaling; linear relationship to storage capacity	Performance limited by a single machine; does not support scaling	Requires the separate purchase of high-end NAS storage devices the configuration of a large number of hard disks
Scaling	Supports elastic scaling and pay-as-you-go billing	Does not support elastic scaling	The storage capacity is limited by hardware; long upgrade cycle
Integration	Standard NFSv3/NFSv4 protocol for seamlessly attachment to CVM instances	Self-deployed software configuration, poor compatibility	Requires complex manual resource management
Cost	Based on the actual storage usage without minimum charges or OPS fees	Requires the advance purchase of hard disks and payment of CVM server and OPS costs	Requires the purchase a complete set of hardware, which represents a large initial investment; high OPS costs
Security management	Supports POSIX permissions, CVM security groups, and attachment in VPC networks	Requires the creation of accounts and a permission system from scratch	Relies on dedicated devices for permission management

2.2.1 CFS Advantages

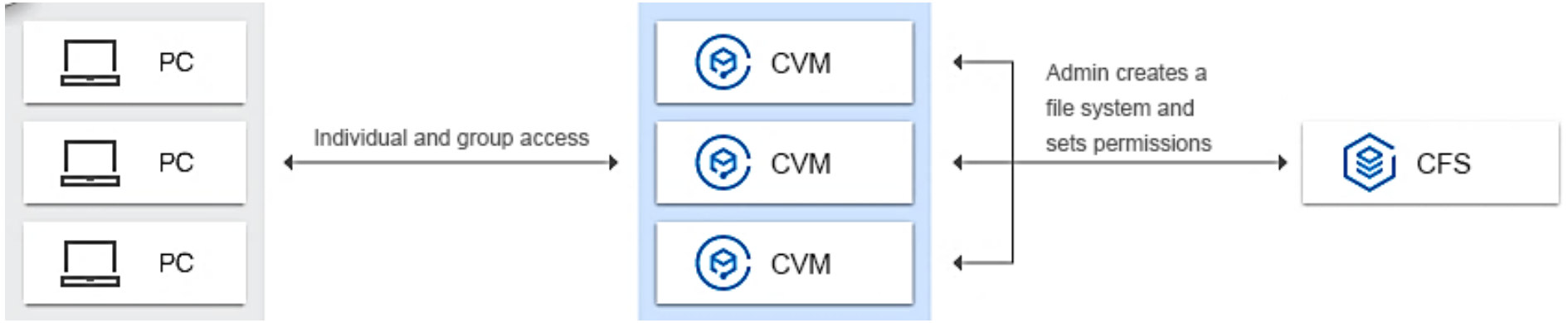
Security:	High performance:	Scalability:
• Supports POSIX permissions • Supports attachment in a VPC network	• Performance scaling • Performance has a linear relationship to storage capacity	• Supports elastic scaling • Scale out as demand grows; pay-as-you-go

2.2.1 CFS vs CBS

	CFS	CBS
Throughput	From 100 MB/s (up to 1.5 GB/s)	Up to 600 MB/s
Sharing	Multi-client sharing	Not supported
Reliability	3 replicas	3 replicas
Access control	Supports POSIX permissions	N/A
Usage	Simply attach and use	Install a file system after mounting

2.2.2 CFS Use Cases

- CFS use cases:
  - Enterprise file sharing
  - Streaming media processing
  - Web services and content management
  - Big data applications

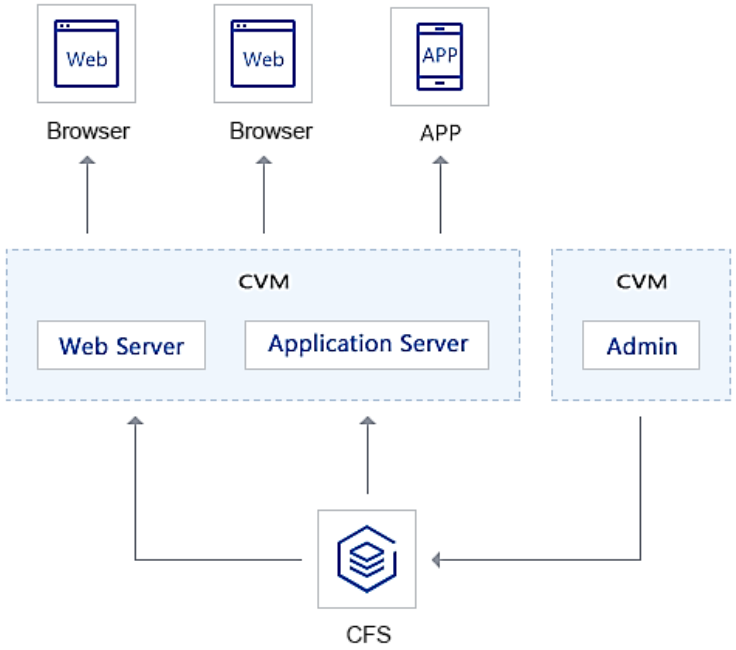


Enterprise File Sharing

2.2.2 CFS Use Cases

Web services and content processing

CFS can be used as a persistent, high-throughput file system for various content management systems that store and provide information for websites, digital distribution, archives, and other applications.



2.3 Cloud Object Storage (COS)

COS is used to store unstructured data, such as video, audio, images, and files.

Use cases: uploading user-generated content from multiple locations, cloud storage with frequent I/O, massive data archiving and backup, hot resource distribution and downloading, etc.

Block Storage	File Storage	Object Storage
• High I/O performance • No file sharing • Directly attach to host	• File sharing • Limited performance • Not suitable for large data volumes • Sharing via NFS/CIFS	• Combines performance and sharing capabilities • Distributed and large-scale • Suitable for big data applications • Accessible via HTTP and other interfaces

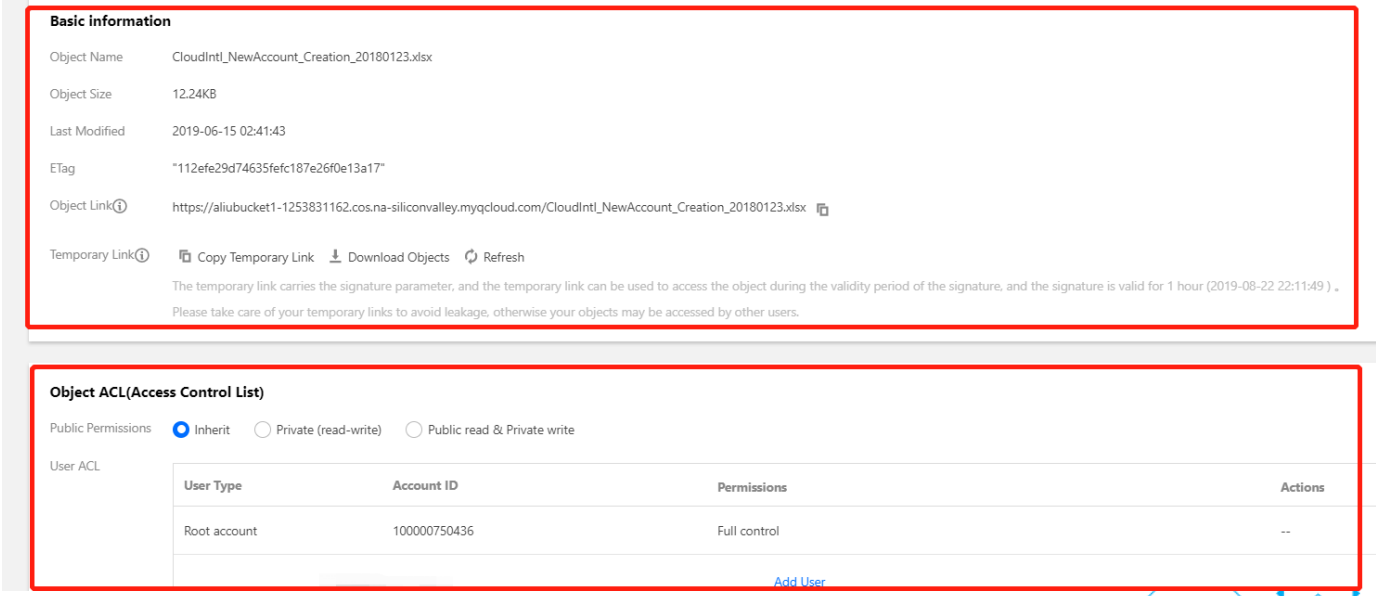
2.3 COS Access Control

- Objects in COS can be accessed and downloaded via **an object link**:

https://dmcos01-12xxxxxx69.cos.ap-guangzhou.myqcloud.com/%E5%9B%BE%E7%89%8701.jpeg

User-defined bucket name + The domain name assigned by the system based on the region / Encoded object name

- **Access control**:
  - **Public permissions**: Private Read and Write, public Read and private Write, public Read and Write
  - **User permissions:** Full control, data read, permission read, permission write



2.3.1 COS Advantages

- **Highly secure - comprehensive protection, decentralized management**
  - Hotlink protection, used to block access from malicious sources
  - Protection against DDoS and CC attacks
  - Filters malicious packets and allows normal traffic to pass
  - Hierarchical permission management system
- **High performance - intelligent scheduling, reliable access**
  - Intelligent scheduling and reliable access: COS supports transmission by block and concurrent requests
  - Uploading via optimal BGP links
  - Combined with CDN to reduce latency and increase download speed

2.3.1 COS Advantages

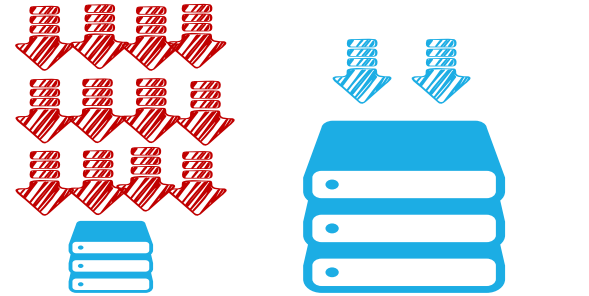
- **High scalability - easy access, one-click migration**
  - Detailed RESTful API access instructions and wide range of SDK access tools
  - Tools for seamless migration
- **Cost-effective – Pay-as-You-Go, auto scaling**
  - No procurement, deployment, or OPS costs
  - Billing based on actual usage
  - No minimum limit, unlimited scaling on demand

2.3.2 COS Use Cases

- COS is used to store unstructured data, such as video, audio, images, and files.
- Use Cases: content delivery, UGC data storage, big data analysis and processing, etc.

2.3.2 Cold Data Archiving

- Why is cold data storage a problem?
  - Most requests access hot data. Only a small portion are for cold data.
  - Most data quickly becomes cold.
  - Cold data results in high storage costs for a small number of requests.



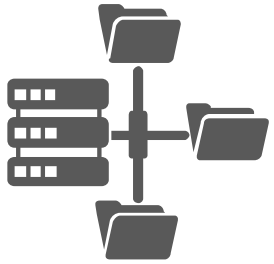
Hot Data Cold Data

2.3.2 Cold Data Archiving (continued)

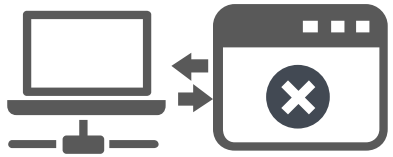
- **Challenges:**

Massive amount of data

Local archives occupy disk space for a long time



Requires elastic scaling



Susceptible to single point of failure
Difficult to ensure data backup/ archive security

- **Use cases:**

Traffic cameras
Security monitors

Medical imaging
Electronic medical records

Historical financial statements

2.3.2 Cold Data Archiving (continued)

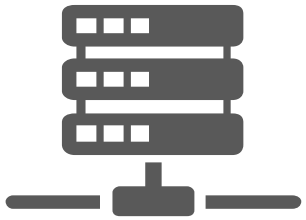
- Use case 1:

  - Data storage for a security monitoring system

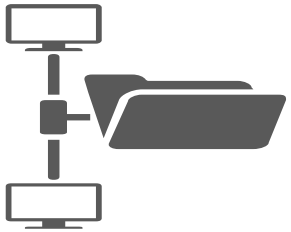
Several TBs	A few weeks	3-6 months
Amount of data generated every day	Period of time the unprocessed data needs to be stored	Period of time the clips and compressed video data need to be stored

  - Data storage requirements for security monitoring:

Security

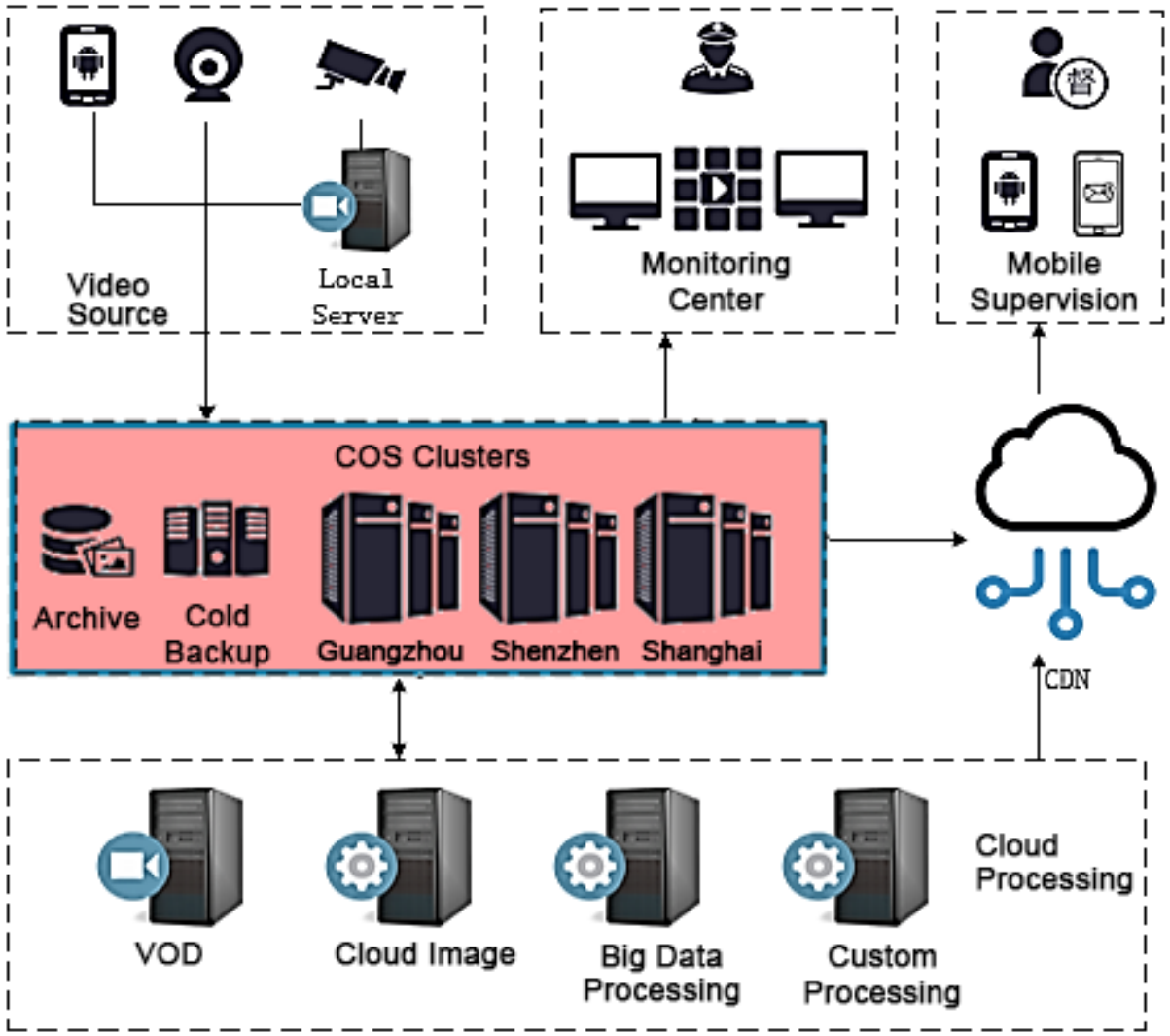


Massive capacity



Fast upload and download speeds

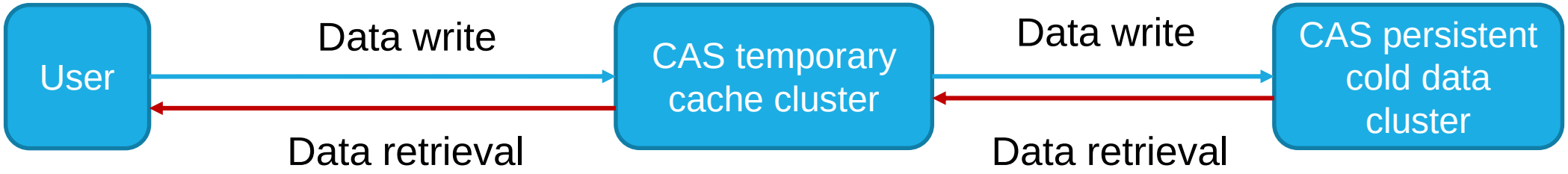
2.3.2 Cold Data Archiving (continued)



2.4 Cloud Archive Storage (CAS)

- Cloud Archive Storage (CAS) is a low-cost, highly reliable, and easily manageable offline cloud storage service.
- CAS accesses archives (storage objects) through vaults (storage containers).

2.4 CAS Data Retrieval



Retrieval mode	Retrieval time
Expedited mode	1 to 5 minutes. Urgent access to files under 256 MB at an increased fee
Standard mode	3-5 hours. Normal fees apply
Batch mode	5-12 hours. Reduced fees; suitable for the retrieval of large amounts of data

2.4.1 CAS vs Traditional Offline Storage

	CAS	Traditional Offline Storage
Stability	Persistent and reliable Supports cross-region disaster recovery, IDC disaster recovery, redundancy with multiple replicas, and data availability up to 99.999999999%	Unstable Supports tape drive backup and optical disc backup; stability depends on the hardware durability
Performance	Fast read and write Data can be retrieved in 1-5 minutes in the fastest retrieval mode. After the data enters the reading pool, the reading speed is close to online storage	Difficult to read Tape drive and optical disc backups are slow to read and write and it takes a long time to retrieve data
Features	Feature-rich Supports multipart upload, multipart download, callback notification, and speed limits	Limited features Only supports file upload and read
Cost	Low cost Cost per GB is much lower than online storage and lower than similar products from other providers	Expensive Average cost per GB can reach several RMB or even over 10 RMB for high-end models
Billing	Pay-as-you-go No minimum usage limit, based on actual usage	Bulk purchase Costs tens of thousands of RMB for tape drives and writers. No usage control provided, and dedicated personnel are required for maintenance
Elasticity	Auto scaling Single users have no capacity limit and do not need to purchase devices	Difficult to scale out The capacity of a single tape drive or a single optical disc is fixed, so you need to purchase more devices to scale out, which is not ideal for rapid business growth
Security	Hierarchical authentication Supports multi-dimensional and multi-factor authentication	Weak permissions management system The account + key mechanism is easily compromised, and the risk of data breach is high

2.4.1 CAS vs. COS

	CAS	COS
Storage container	Vault	Bucket
Storage object	Archive	Object
Storage type	Offline storage	Online storage
Access by	Archive ID	Object data, object index
Data retrieval	No real-time retrieval. Complicated process	Real-time retrieval. Easy to retrieve
Price	Low	High

2.4.1 CAS Advantages

- **Security:**
  - Supports hierarchical authentication and allows multi-dimensional and multi-factor authentication
- **Scalability:**
  - Auto scaling
  - No per-user storage capacity limit
  - No need to purchase devices in advance
- **Low costs:**
  - Cost per GB is much lower than online storage and lower than the prices offered by other providers
  - Pay-as-you-go, no minimum usage limit

2.4.2 CAS Use Cases

Use cases of CAS

Video Surveillance

- Traffic cameras
- Real estate surveillance video
- Railway station, airport, and customs surveillance video
- Liveness detection and video recording for banking
- Pet monitoring video recording
- IoT platforms

Scientific Experiments and Medical Data

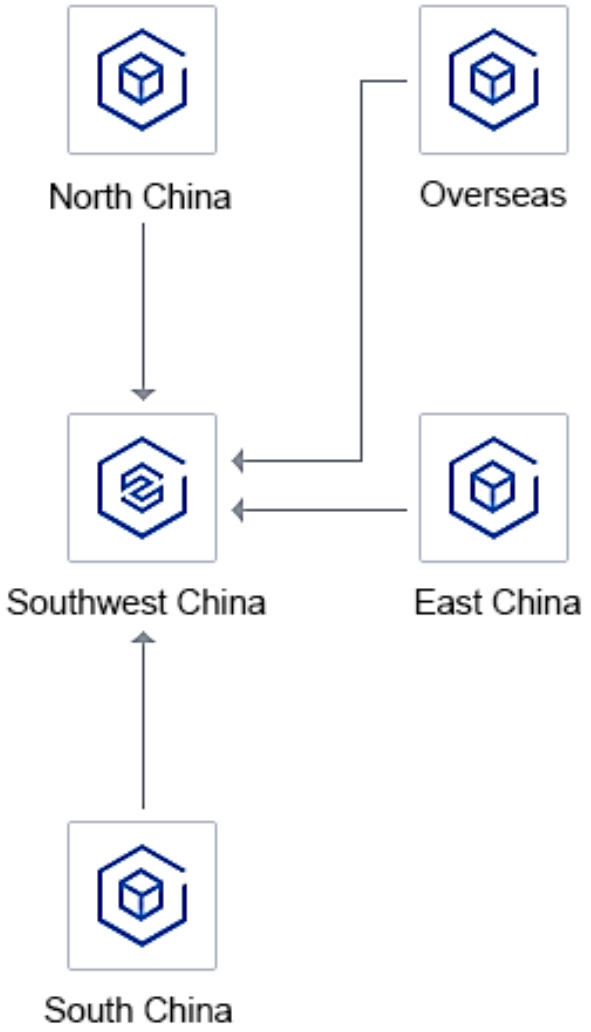
- Processed genetic data
- Medical experiment data
- Medical imaging
- Electronic medical records and health databases

Database and System Service Integrators

- Database archives
- File system snapshots
- User logs
- Archived user emails
- PaaS service providers
- SaaS service providers

2.4.2 Remote Disaster Recovery for Critical Data

- Users can store primary site data on core storage nodes in North China, South China, and East China, and store replicas on CAS instances in Southwest China. Data on CAS instances can be retrieved in 1-5 minutes, making quick disaster recovery possible.



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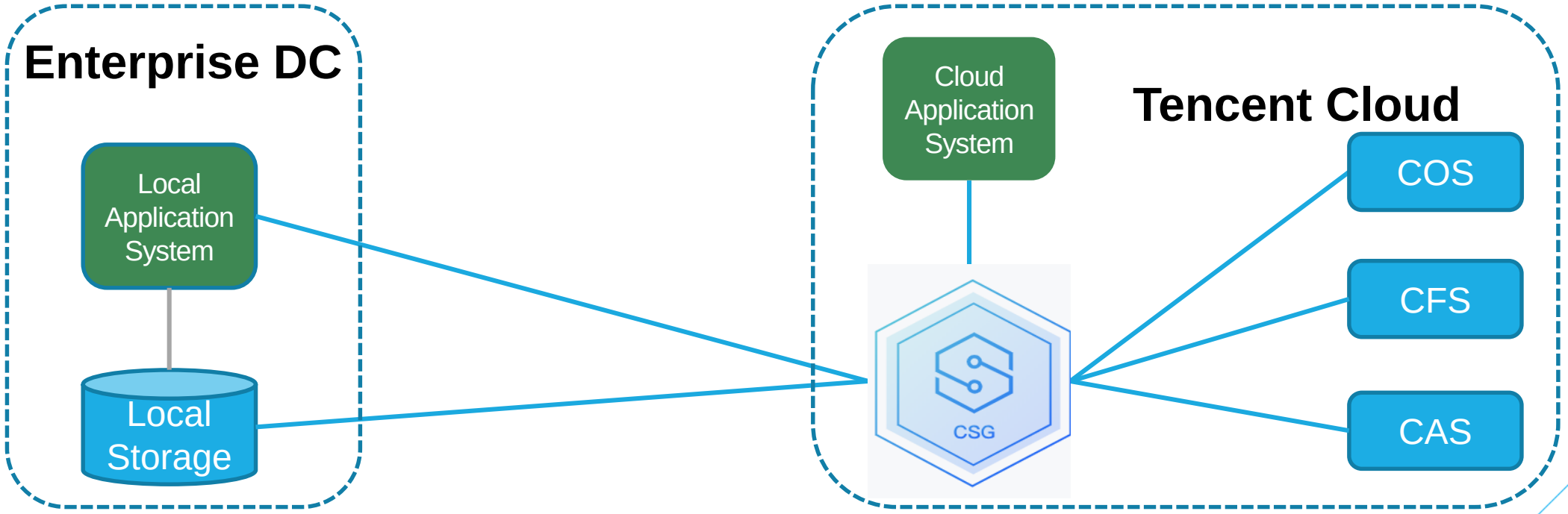
Chapter 3 Tencent Cloud Storage Services

3.1 Cloud Storage Gateway (CSG)

- Cloud Storage Gateway (CSG) is a hybrid cloud storage solution that seamlessly integrates local storage/private cloud and public cloud storage.

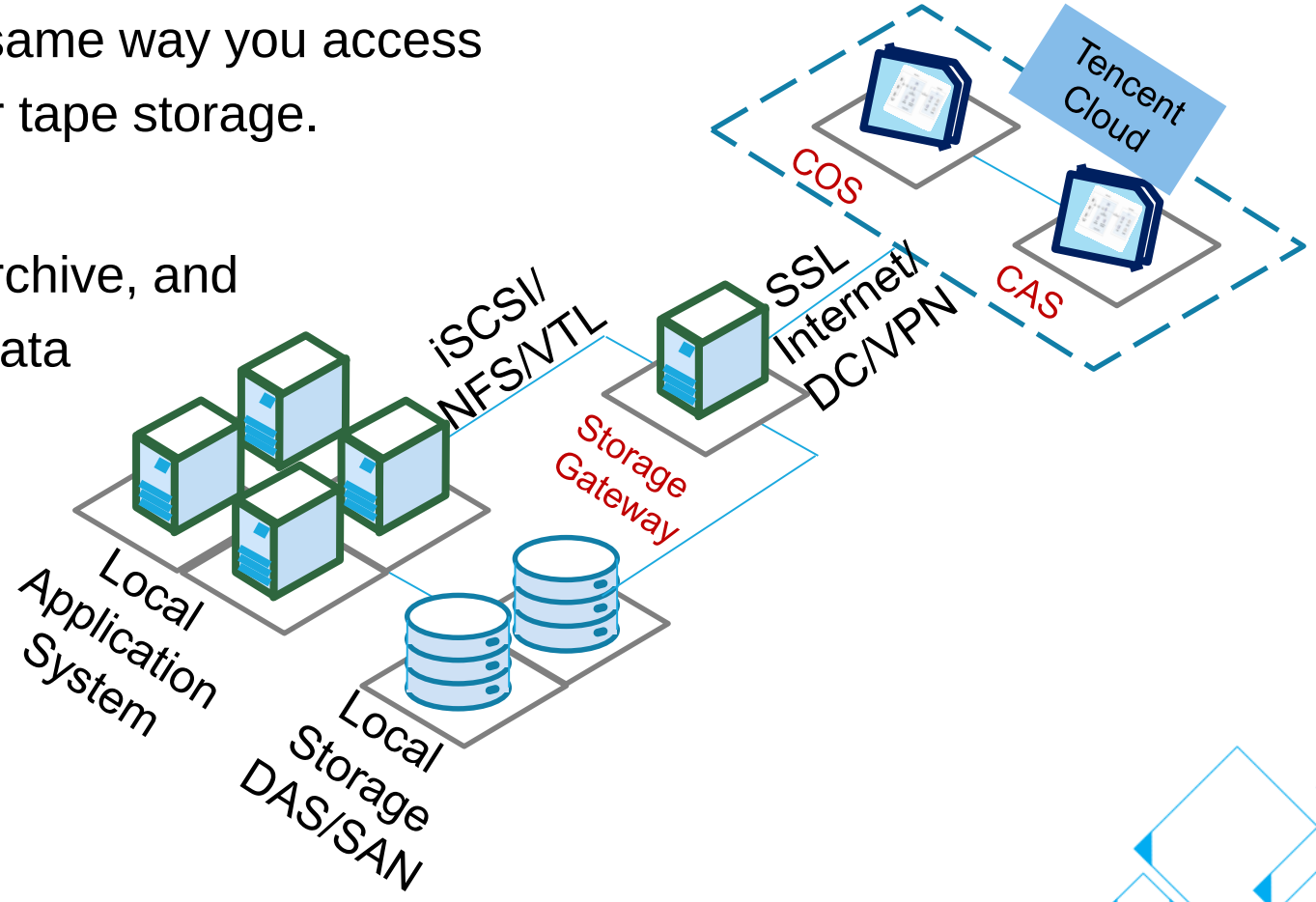


3.1 CGS Components

Storage gateway	Volume gateway	File gateway	Tape gateway
Access protocol	ISCSI	NFS3/NFS4.1	VTL
Backend storage	COS	COS	CAS

3.1 Hybrid Cloud Storage Architecture

- Hybrid cloud storage architecture
  - By deploying a storage gateway in a private cloud, you can access COS and CAS in the same way you access SAN storage, NAS storage, or tape storage.
  - CSG reduces the storage and maintenance costs of audit, archive, and backup data, while ensuring data security.



3.1 Introduction to Storage Gateways

	Volume gateway	File gateway	Tape gateway
Access protocol	iSCSI	NFS3/NFS4.1	VTL
Snapshot	Supported	Not supported	Not supported
Auto scaling	Supported	Supported	Supported
Data encryption	Supported	Supported	Supported
Network configuration	Supported	Supported	Supported
Access acceleration	Supported	Supported	Supported
Use cases	Local storage expansion, data backup	Enterprise cloud storage, big data analysis	Archive storage for media, compliance documents, and backup data

3.1.1 CSG Advantages

Interface Development

Protocol Translation

Public cloud: HTTP, RESTful, API
Storage gateway:
iSCSI(DAS, SAN)
NFS (NAS)
VTL (virtual tape)

Data Security

Data Encryption

1. Local USB Key encryption: Random encryption or full encryption
2. Block encryption: Data is encrypted at block level before uploading

Bandwidth Usage

Compressed Before Uploading

Type	Compression Ratio
PDF	2.5
Text file	3
Image	1.5
Database file	2.5

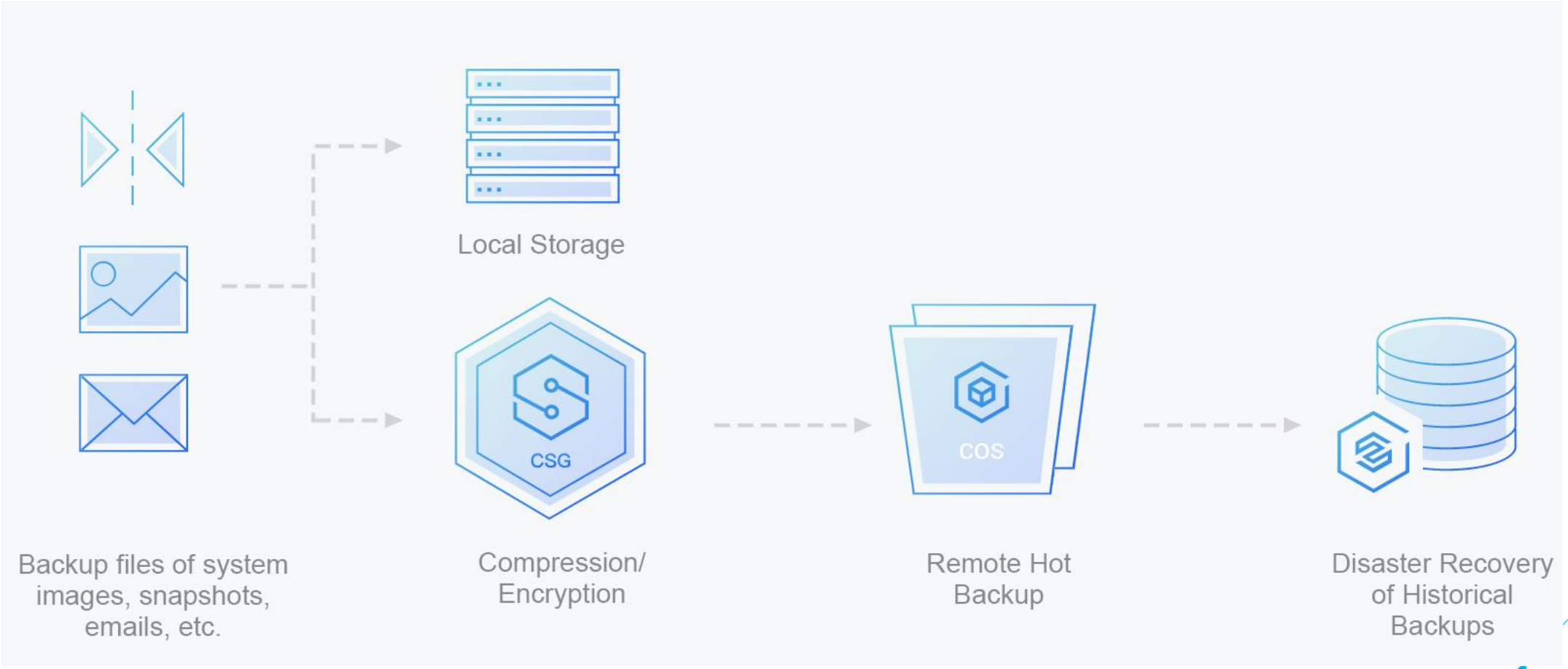
Read and Write Latency

Access Acceleration

1. Read: Comparable to local storage performance for hot data
2. Write: The write speed of the upload buffer is comparable to local storage

3.1.2 CSG Use Cases

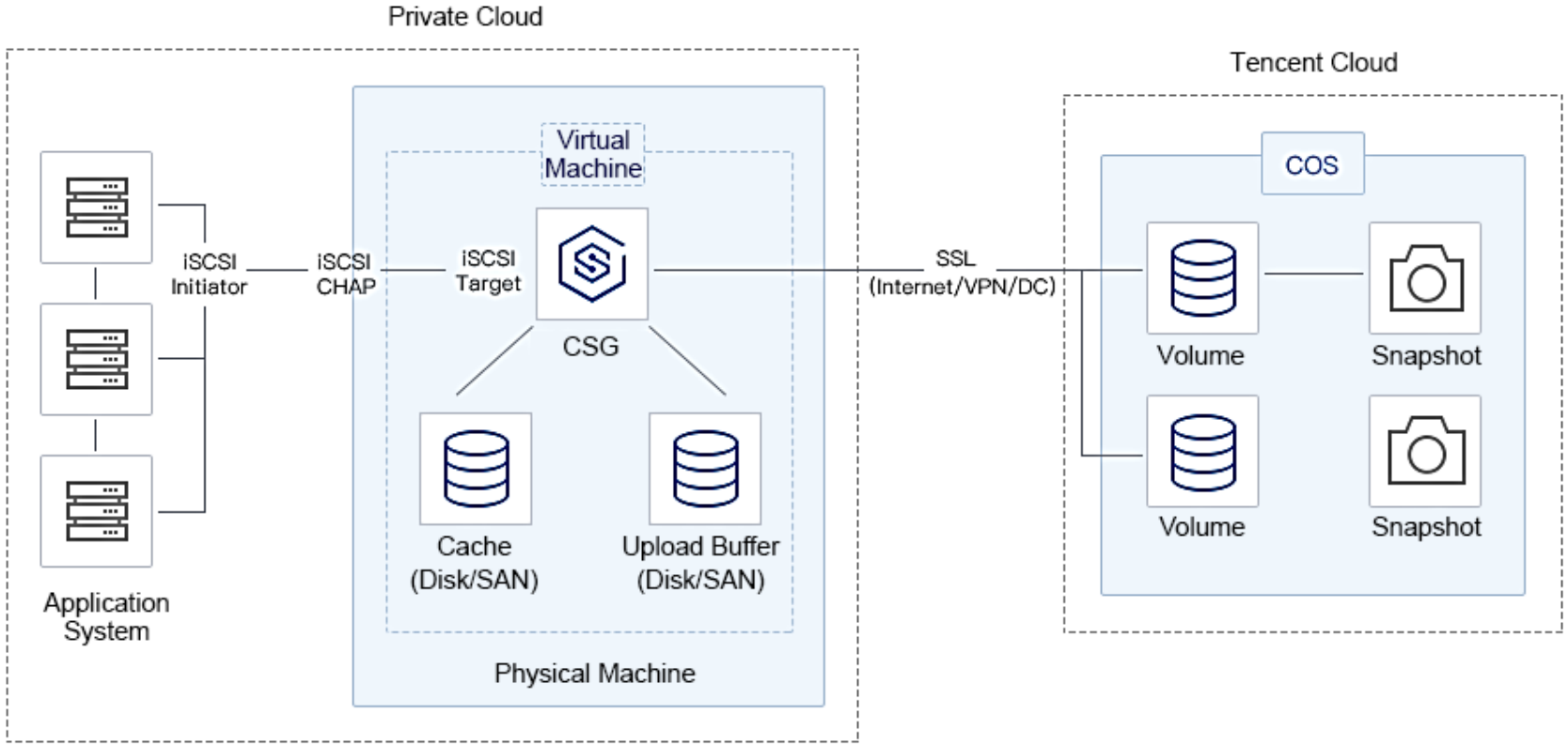
- Hybrid cloud loads, backup and disaster recovery, data distribution, data migration



taken and stored on Tencent Cloud COS

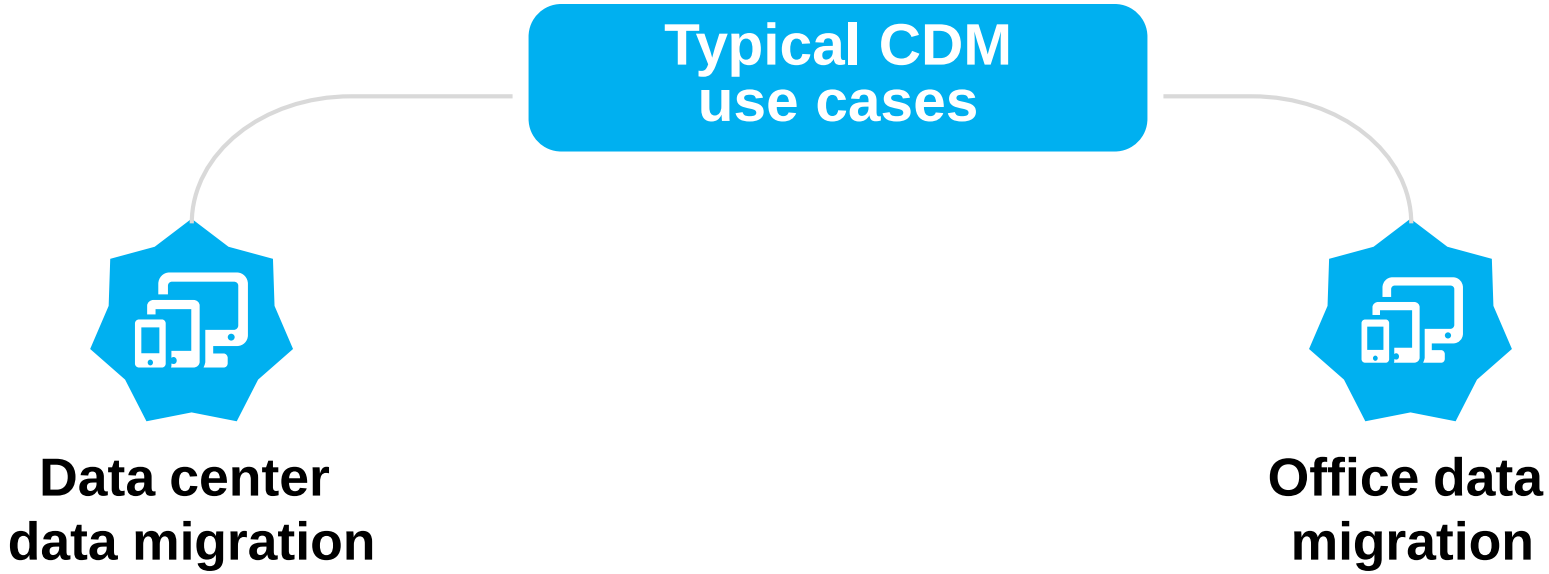
Use these snapshots to recover volumes that can be attached to a cloud storage gateway

3.1.2 Remote Disaster Recovery for Critical Data



3.2 Cloud Data Migration (CDM)

- Cloud Data Migration (CDM) is a secure and reliable offline cloud migration service for terabyte- or petabyte-scale data.
- CDM Advantages: Efficient transmission, security, and status tracking.

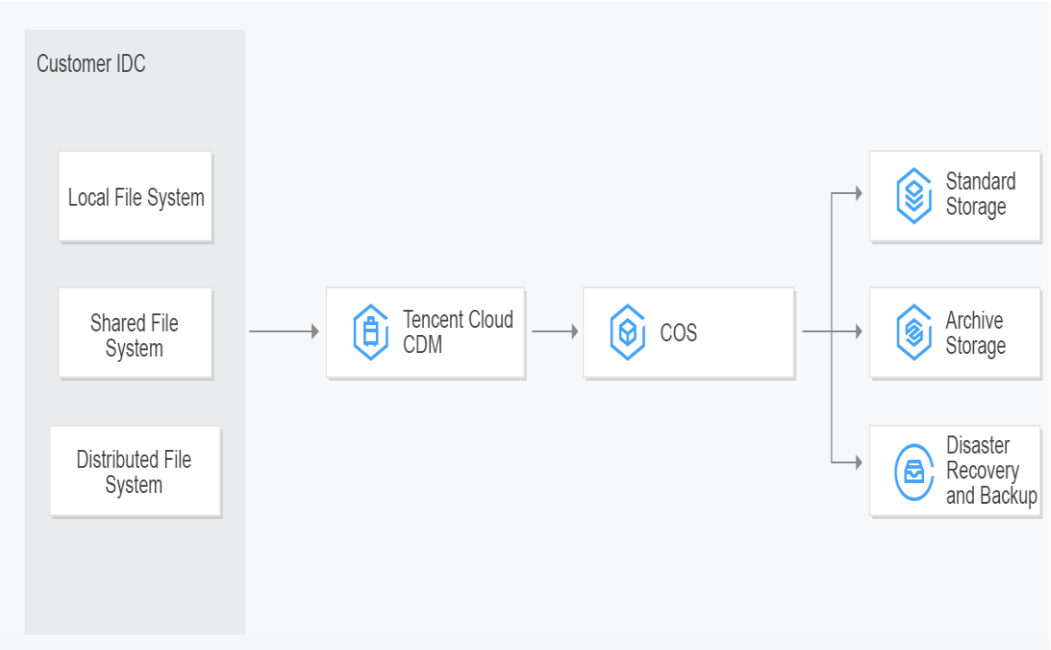


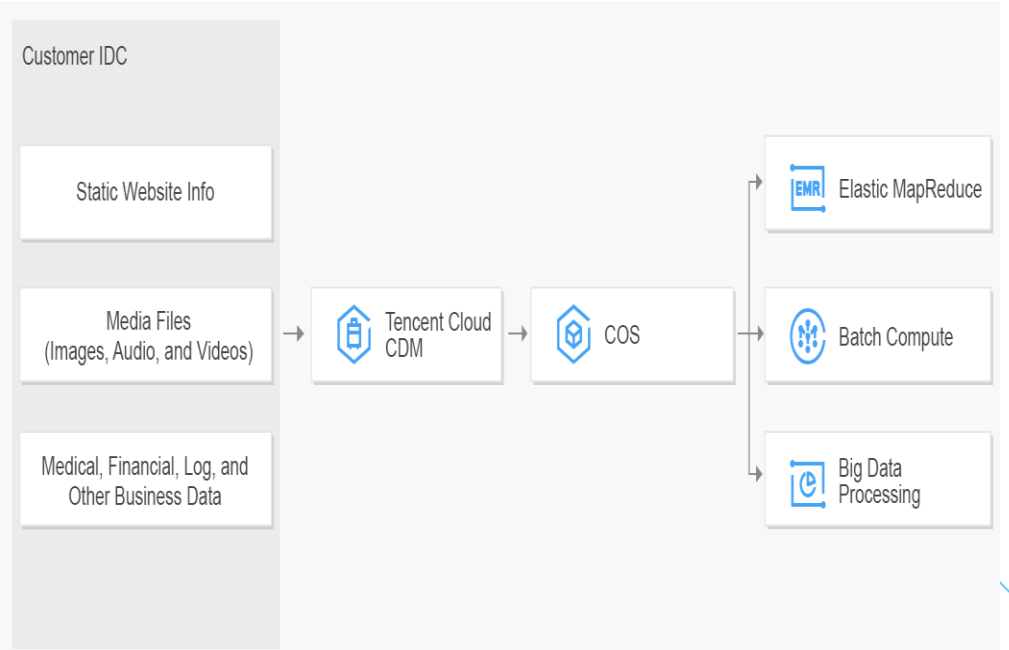
3.2.1 CDM Advantages

- **Secure**
  - Device-side encryption and decryption, self-managed keys
  - Integrated with Tencent Cloud CAM, allowing you to manage task progress and permissions
  - After data migration is complete, each sector of the devices' disks is erased to ensure that the data is inaccessible
- **Efficient**
  - Fast and stable
  - Optimized for small files
  - Professional logistics
- **Low costs**
  - Cost-effective
  - Efficient deduplication

3.2.2 CDM Use Cases

- Backups for massive data archives
- Cloud data analysis and processing
- Data migration with network with poor connectivity





3.3 Cloud Log Service (CLS)

- Cloud Log Service (CLS) is a one-stop log service platform that provides the following capabilities:
  - Log collection: Collects logs in real-time through LogListener and APIs
  - Log retrieval: Supports real-time indexing and searches of tens of millions of logs with results returned in seconds
  - Log shipping: Logs can be delivered to COS for log lifecycle management

- Log types:
  - System logs, application logs, mobile logs, embedded device logs, etc.

3.3.1 CLS Advantages

High reliability

Tencent Cloud CLS

- Supports redundancy with multiple replicas
- Data persistency: 99.99999999%
- Availability: 99.9%

Traditional Log System

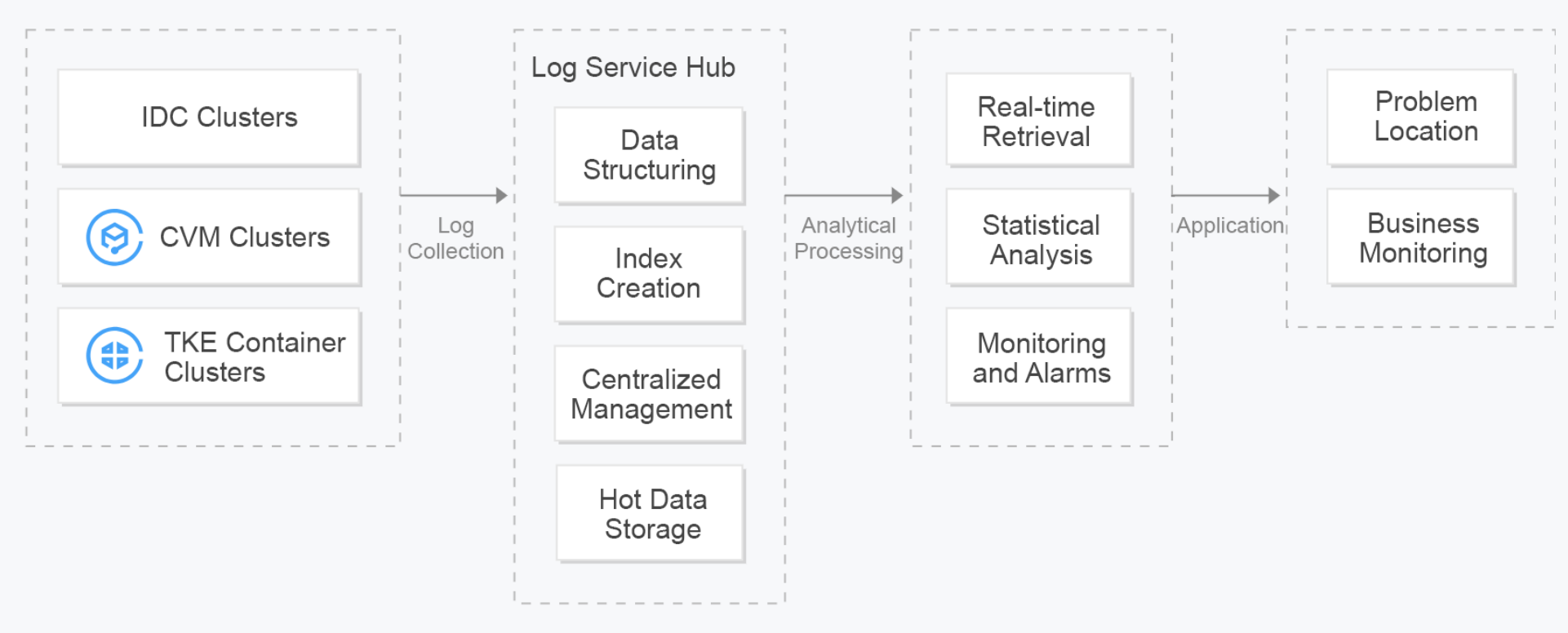
- System reliability is affected by networks, hosts, and other equipment failures
- Risk of data loss due to system changes and upgrades

3.3.1 CLS Advantages (continued)

- High performance: Quick retrieval
  - Configurations take effect quickly and return results instantly
  - Large-capacity log storage for the daily collection of log volumes in the terabytes
- Scalability: Elastic auto scaling
  - Provides support for log data from scales from megabytes to terabytes.
  - No need to purchase devices
- Cost-effectiveness
  - Pay based on actual usage at a low rate
  - No need to worry about resource waste

and security auditing through log collection and analysis

3.3.2 CLS Use Cases



Contents

Chapter 4 Cloud Storage Billing Plans

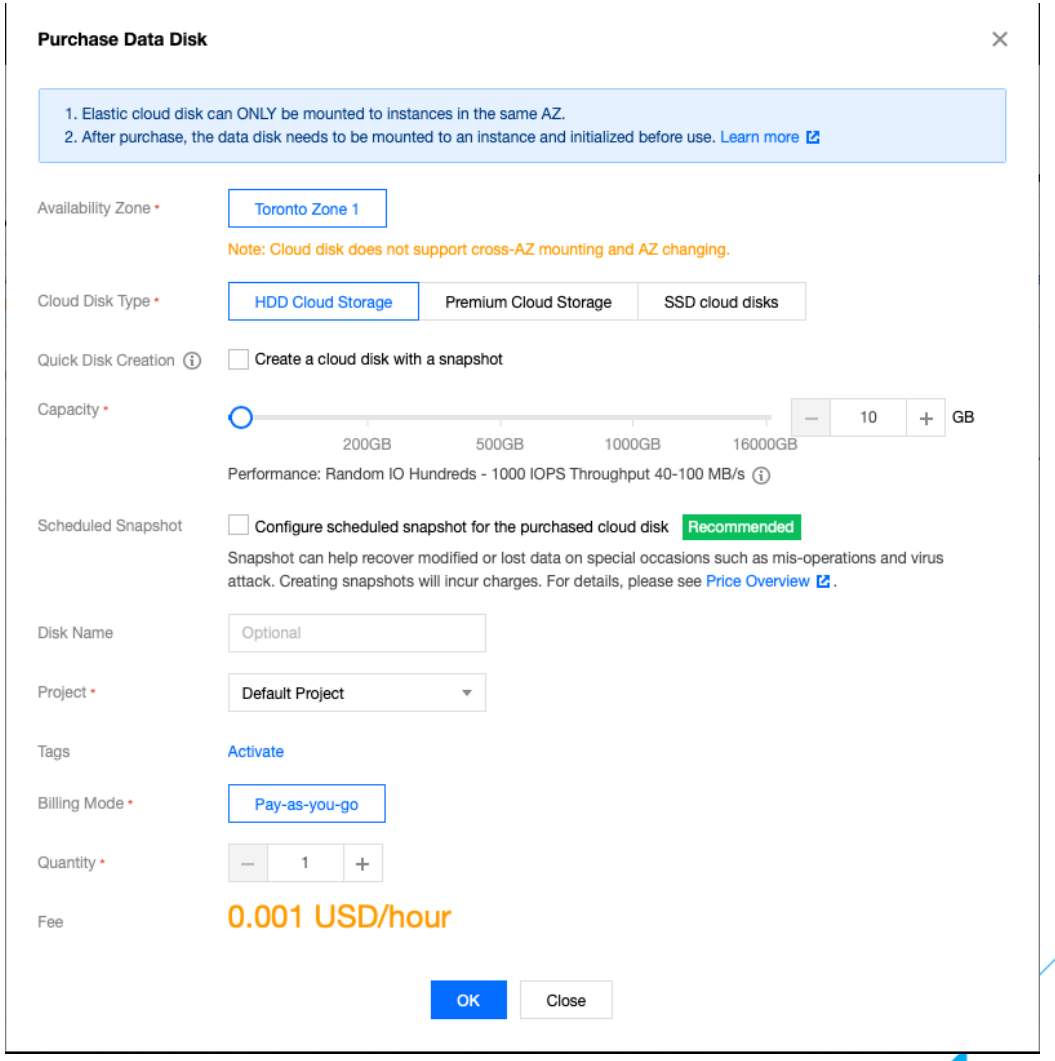
not provided on the international site yet.

4.1 CBS Billing Plan

Billing Method

Tencent Cloud CBS is Pay-as-You-Go, so you only pay for what you use. This flexible billing method is designed to meet your demands in multiple business scenarios.

For detailed pricing for CBS, see here.



4.2 CFS Billing Plans

Billing Method

CFS (Cloud File Storage) charges you for storage you actually used. There is no minimum amount you have to pay, nor cost of traffic or request. Storage is calculated by the maximum storage amount used every hour, and the charge cycle is on a hourly basis.

Price Details

See below for CFS product pricing. NFS and CIFS/SMB file systems have the same price.

Billing Method/Region	Mainland China
Price	0.058 USD/GB/Month (0.00008056 USD/GB/hr)

For detailed pricing for CBS, see here.

4.3 COS & CAS Billing Plans

Billing Method

COS supports Pay-as-You-Go billing method for all regions. The fees for storage capacity, requests, and data retrievals are **settled on a monthly** basis. Fees for the previous month are settled and billed on the 3rd to 5th days of each month.Traffic fees are **settled on a daily basis**. Fees for the past day are settled and billed everyday. At the time of bill settlement, the system will settle in the order of **Free Tier > Pay-as-You-Go billing**.

Free Tier

You are eligible for a certain amount of standard storage capacity provided by COS free of charge. For more information, see Free Tier.

Billable Items

Billable items in COS include storage capacity, requests, data retrievals, and traffic. For pricing details, see COS Pricing.

4.3 COS & CAS Billing Plans

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Pay-As-You-Go Pricing

Export

Region	Storage Type	Billing Items					
		Storage Capacity Cost (USD/GB/month)	Read/Write Request Cost (USD/10k requests)	Data Retrieval Cost (USD/GB)	Traffic Cost (USD/GB)		
					Internet Downstream Traffic	CDN Origin-pull Traffic	Cross-origin Replication Traffic
Chengdu (Southwest China), Chongqing (Southwest China)	COS Standard	0.02	0.002	0	0.1	0.02	0.05
	COS Infrequent Access	0.014	0.01	0.002			
	Archive Storage	0.0045	0.0147 (read/write only after recovery)	expedited retrieval: 0.03 standard retrieval: 0.01 bulk retrieval: 0.0025	0.1 (applicable only after recovery)	N/A	N/A
Beijing (North China), Shanghai (East China), Guangzhou (South China)	COS Standard	0.024	0.002	0	0.1	0.02	0.1
	COS Infrequent Access	0.018	0.01	0.002			
	Archive Storage	0.005	0.0147 (read/write only after recovery)	expedited retrieval: 0.03 standard retrieval: 0.01 bulk retrieval: 0.0025	0.1 (applicable only after recovery)	N/A	N/A

Summary

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- **This course covered the following topics:**
  - Storage basics: Brief history, storage type, storage media, storage tiering
  - Tencent Cloud storage products: CBS, CFS, COS, CAS
  - Tencent Cloud storage services: CSG, CDM, CLS
  - Storage billing plans: Billing plans for each storage product and service

Thank you