

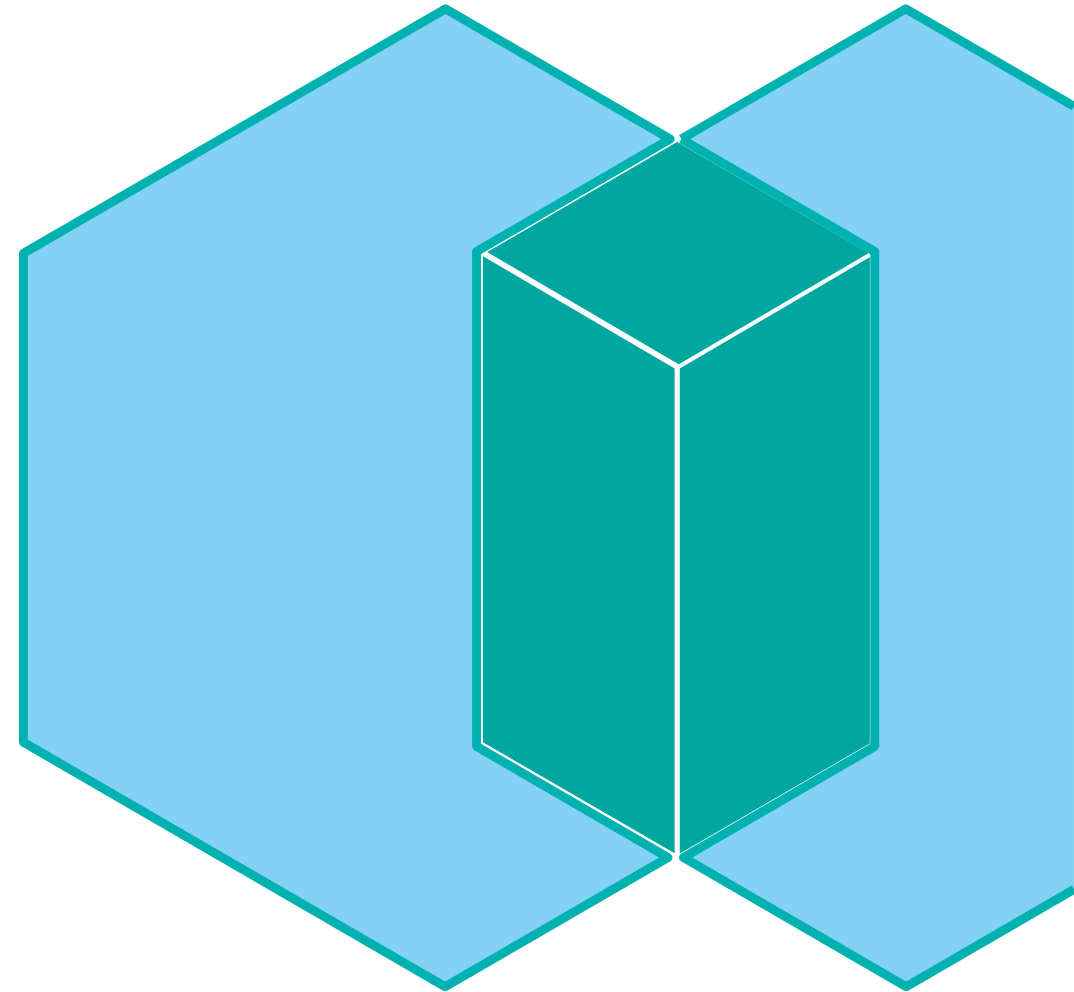


# Multi-cloud with Transparent Cloud Tiering

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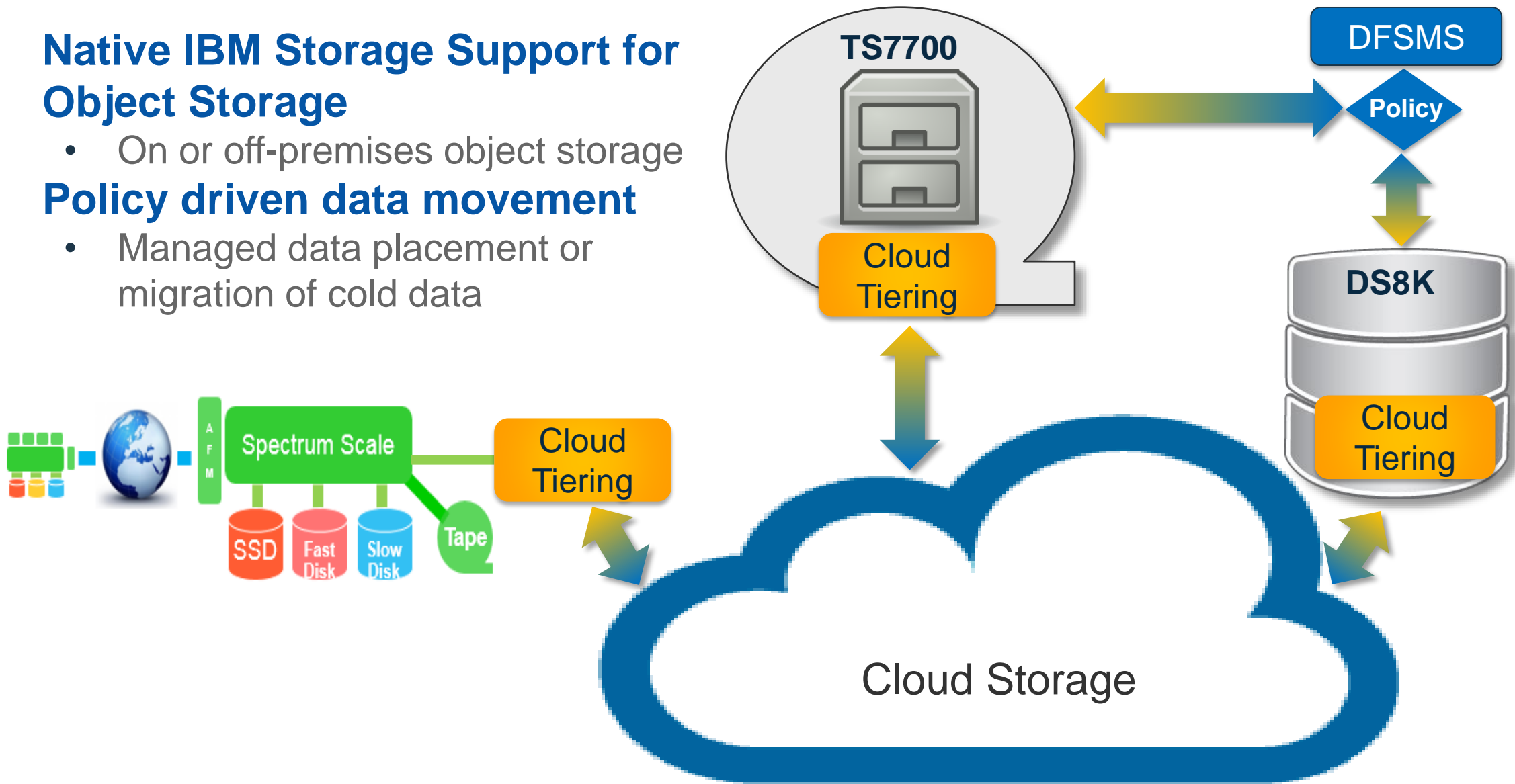
# Agenda

- Spectrum Scale Transparent Cloud Tiering introduction
  - Capabilities
  - Cloud integration scenarios
- Real-world use cases
  - Autonomous driving measurement data
  - Bodycam recordings
  - Tape backup replacement
  - SaaS provider leveraging public cloud
  - Video surveillance „anti-use-case“

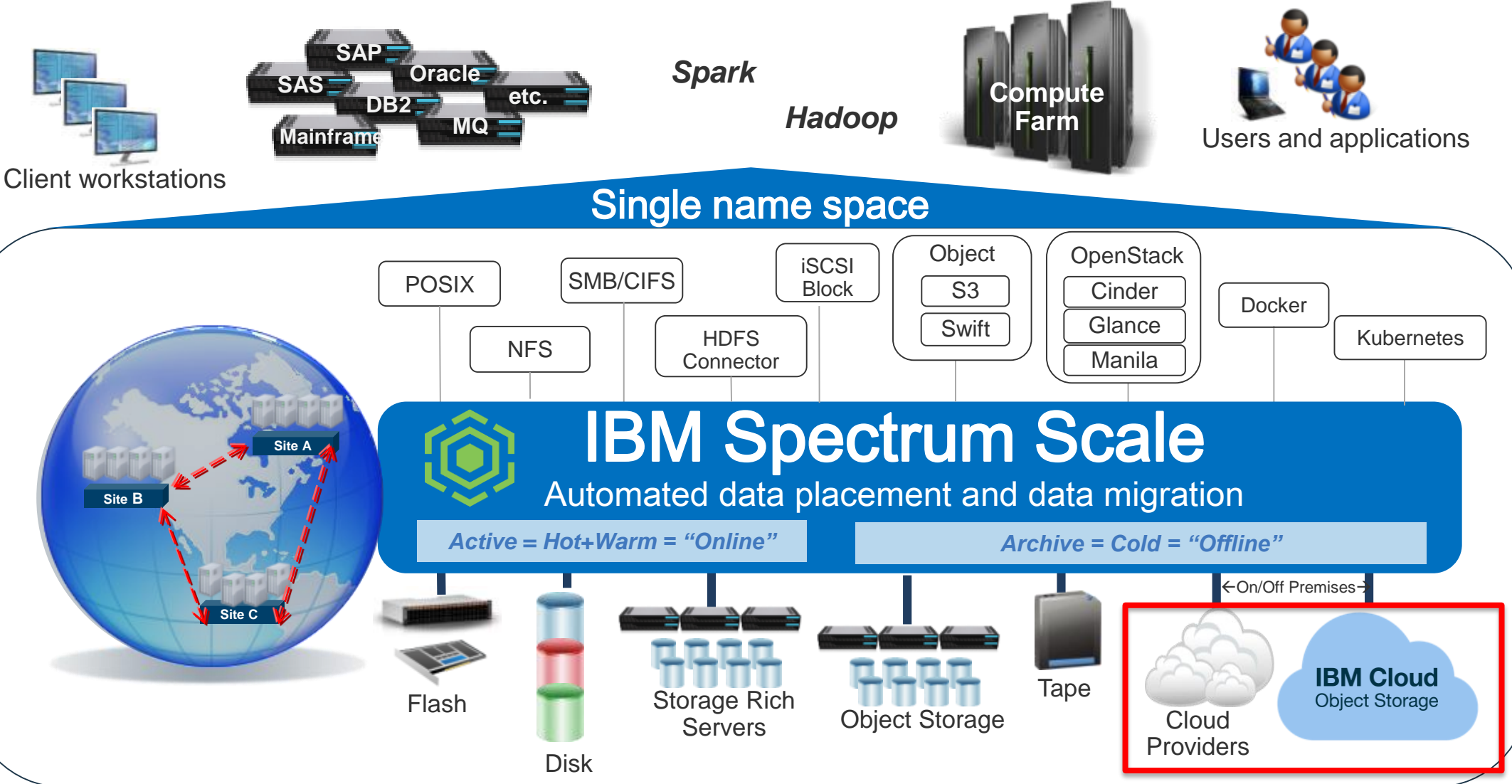
# Transparent Cloud Tiering Is Used Across IBM Storage

## Native IBM Storage Support for Object Storage

- On or off-premises object storage
- ### Policy driven data movement
- Managed data placement or migration of cold data

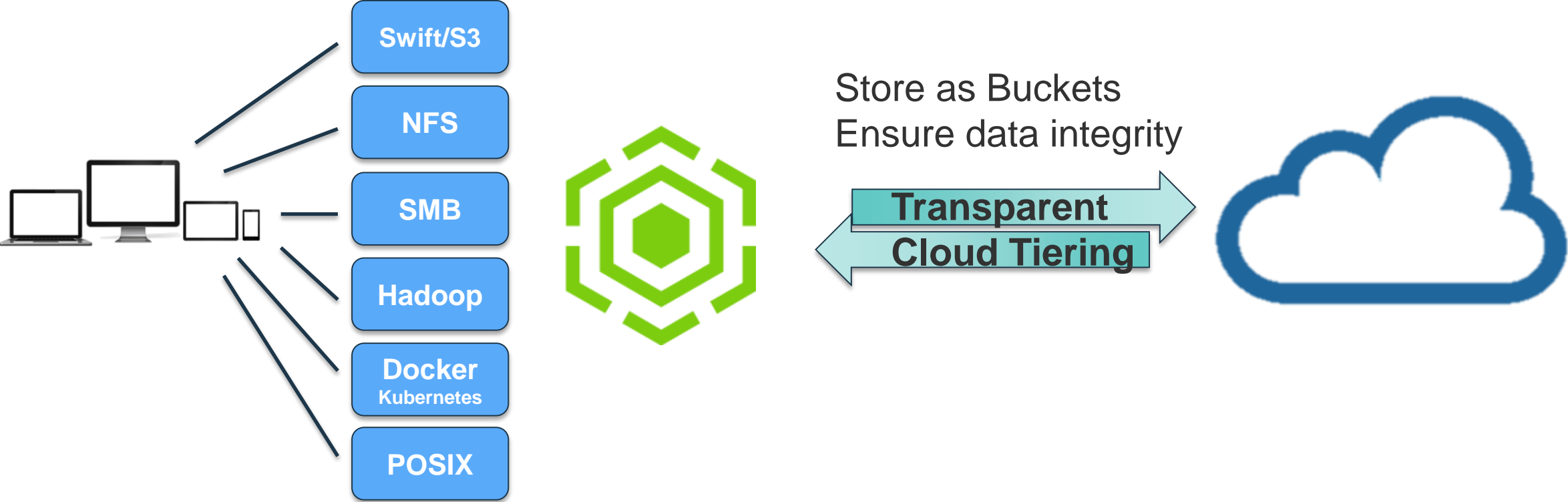


# IBM Spectrum Scale – scalable file and object store



# Spectrum Scale Transparent Cloud Tiering Introduction

# Spectrum Scale Transparent Cloud Tiering (TCT)



Transparent Data

Metadata is managed by Spectrum Scale

Cloud appears as external storage pool  
Auto-tiering & migration

# Protocol mapping vs. Transparent Cloud Tiering

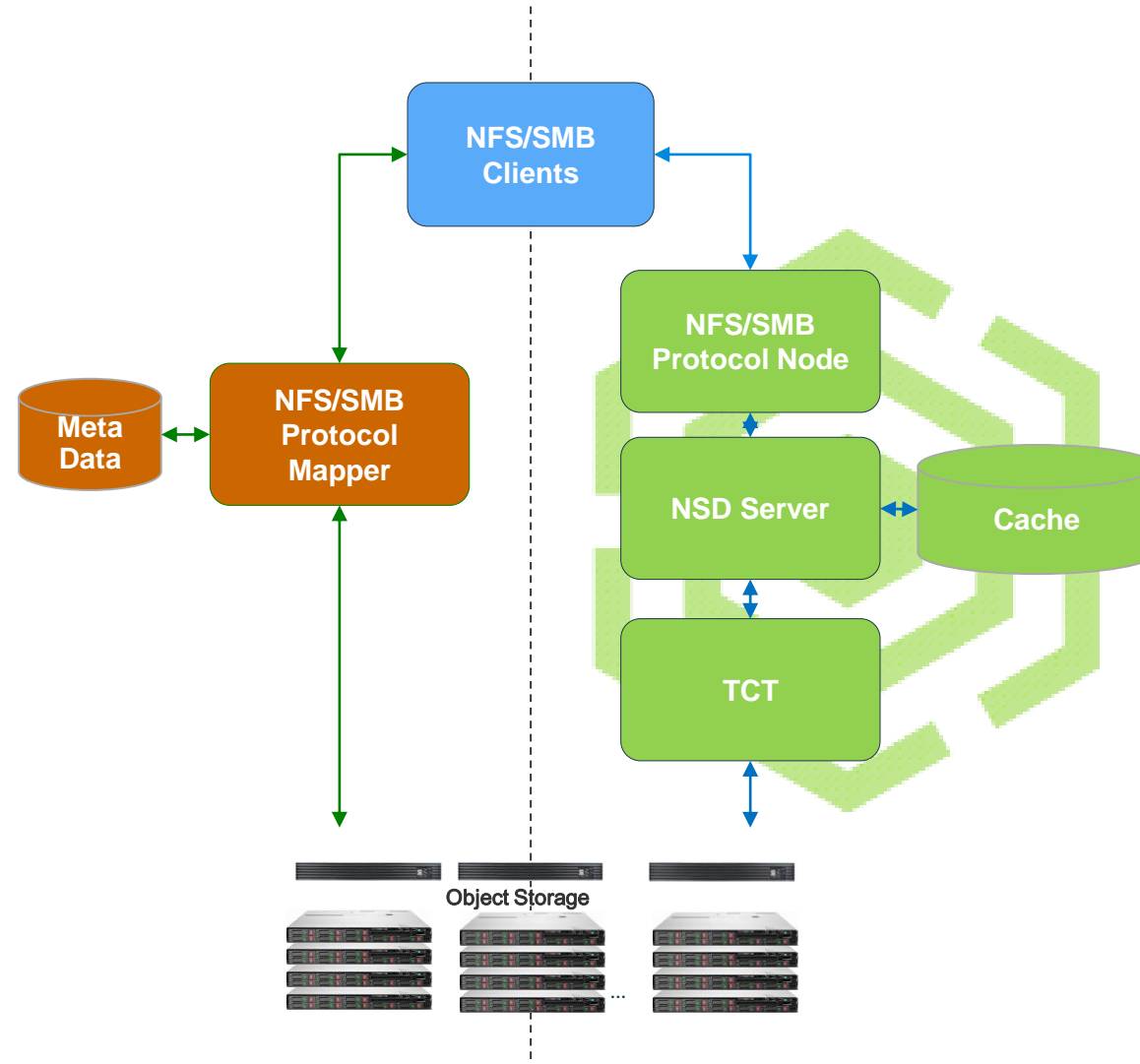
## Protocol Mapping

### Pros

- Simple Architecture
- No cache storage

### Cons

- All writes&reads have to be mapped
- No cache for high-performance read/write
- Often vendor mix required



## Transparent Cloud Tiering

### Pros

- High performance write operations
- High performance read for cached data
- Public cloud-ready

### Cons

- More complex architecture
- Cache storage required
- Increased response time for non-cached data

# Spectrum Scale TCT value

- Extend Spectrum Scale to private or public cloud
  - Open object store interfaces drive new Data Economics
  - Public Cloud:
    - IBM Cloud Object Storage
    - IBM Bluemix Object Storage
    - Amazon S3
  - Private Cloud or on-premises:
    - IBM Cloud Object Storage
    - OpenStack Swift
- Transparent to end-users using Spectrum Scale
- Enhancing Object Storage choice
  - Spectrum Scale as High-Performance, unified file&object
  - IBM Cloud Object Storage as cost-optimized, scalable object storage





# Recommended Environment for Spectrum Scale TCT

- Requires Spectrum Scale Advanced / Data Management
- Available upon request, prerequisites are
  - Appropriate file sizes (>1MB, the larger, the better)
  - Stable data for long-term retention
    - Files likely to be updated or deleted (reads are ok)
  - Sufficient Object Storage capacity
  - Appropriate network connectivity to cloud storage, load balancing



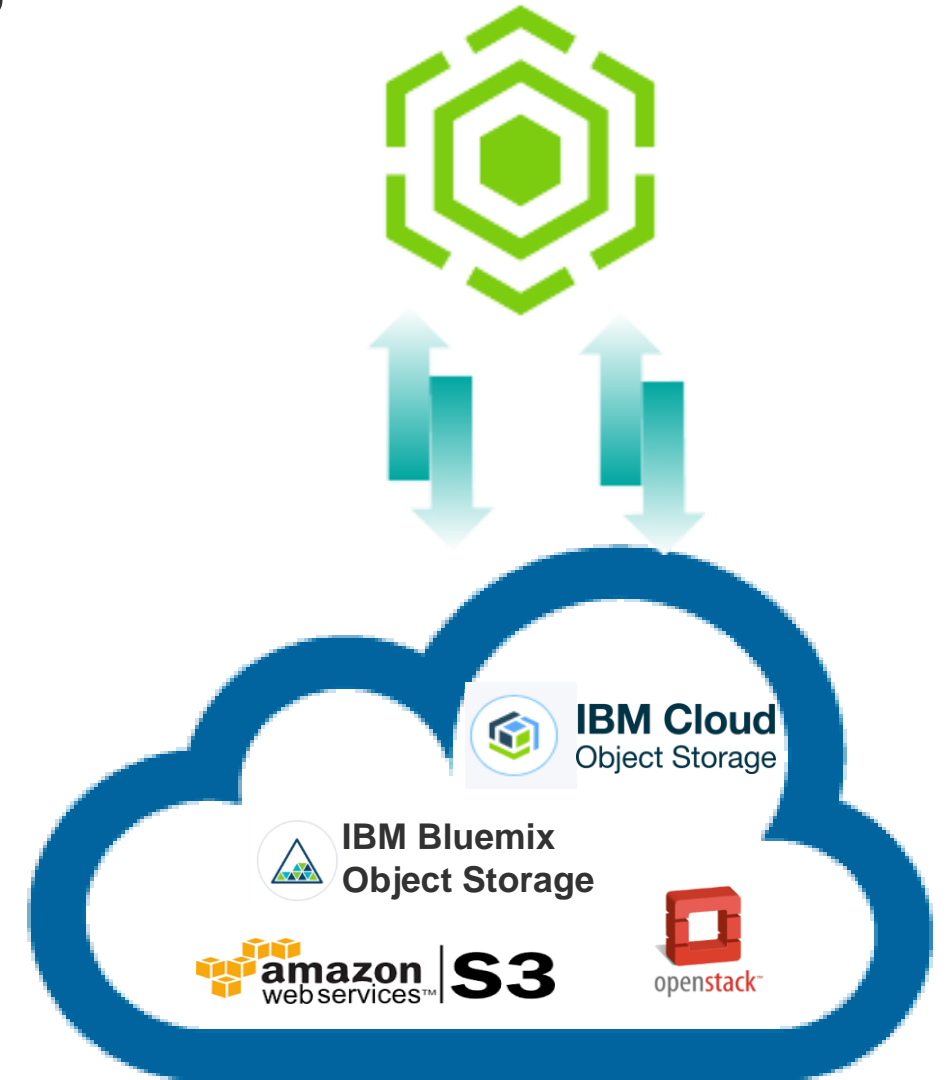
# Spectrum Scale TCT capabilities (4.2.1)

- Up to 4 TCT nodes as part of Cloud Service node class
  - Simultaneous data transfer
  - High-availability
- Encryption by default
  - Local key store and ISKLM support
- Policy-based data movement and lifecycle
- Transparent recall
- Built-in integrity checking



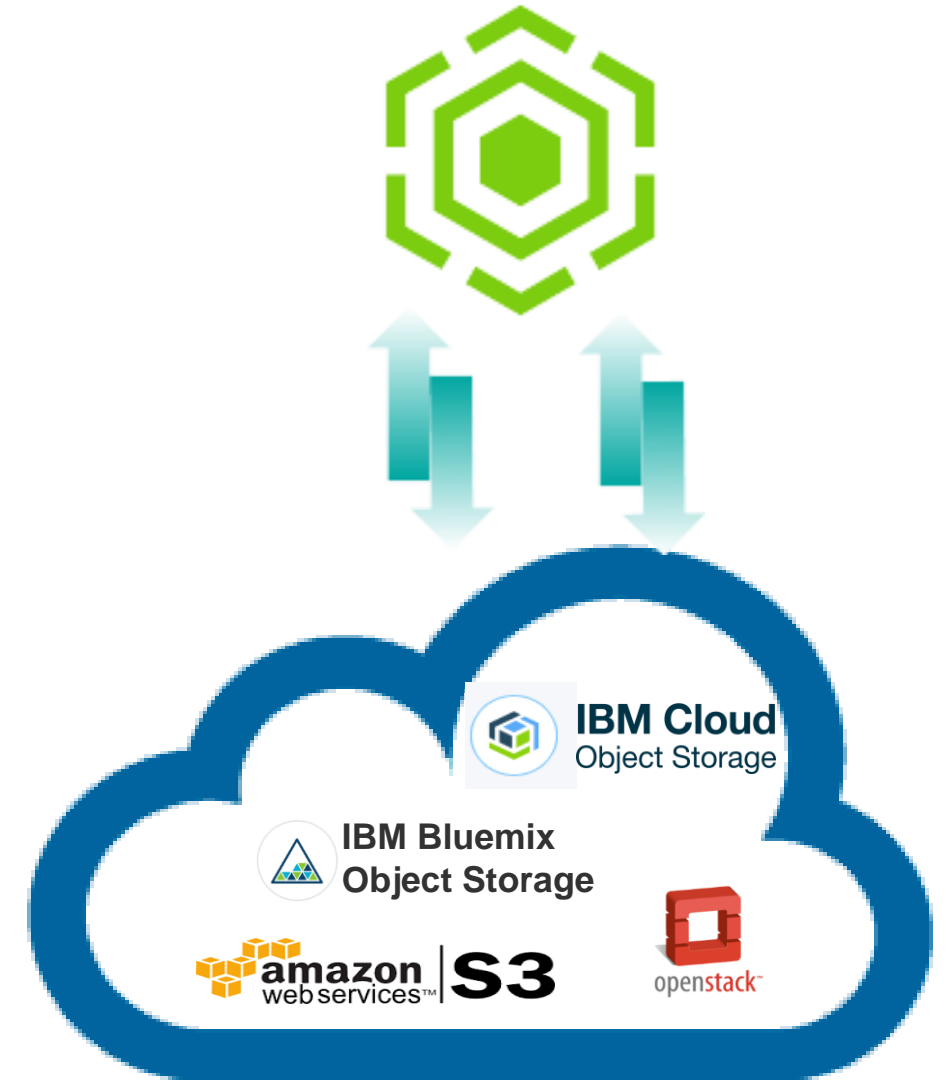
## Spectrum Scale TCT capabilities (4.2.2)

- Support for up to 4 node classes for additional scaling
- Cloud Data sharing
  - Data import/export to/from cloud, preserves data and allows native access on both ends
  - Export can be policy-based, import requires object list
- Windows explorer thumbnail support
  - Keep portion of migrated data to support thumbnails
- Spectrum Scale GUI integration
  - Health state
  - High-level operations/throughput monitoring



## Spectrum Scale TCT capabilities (4.2.3)

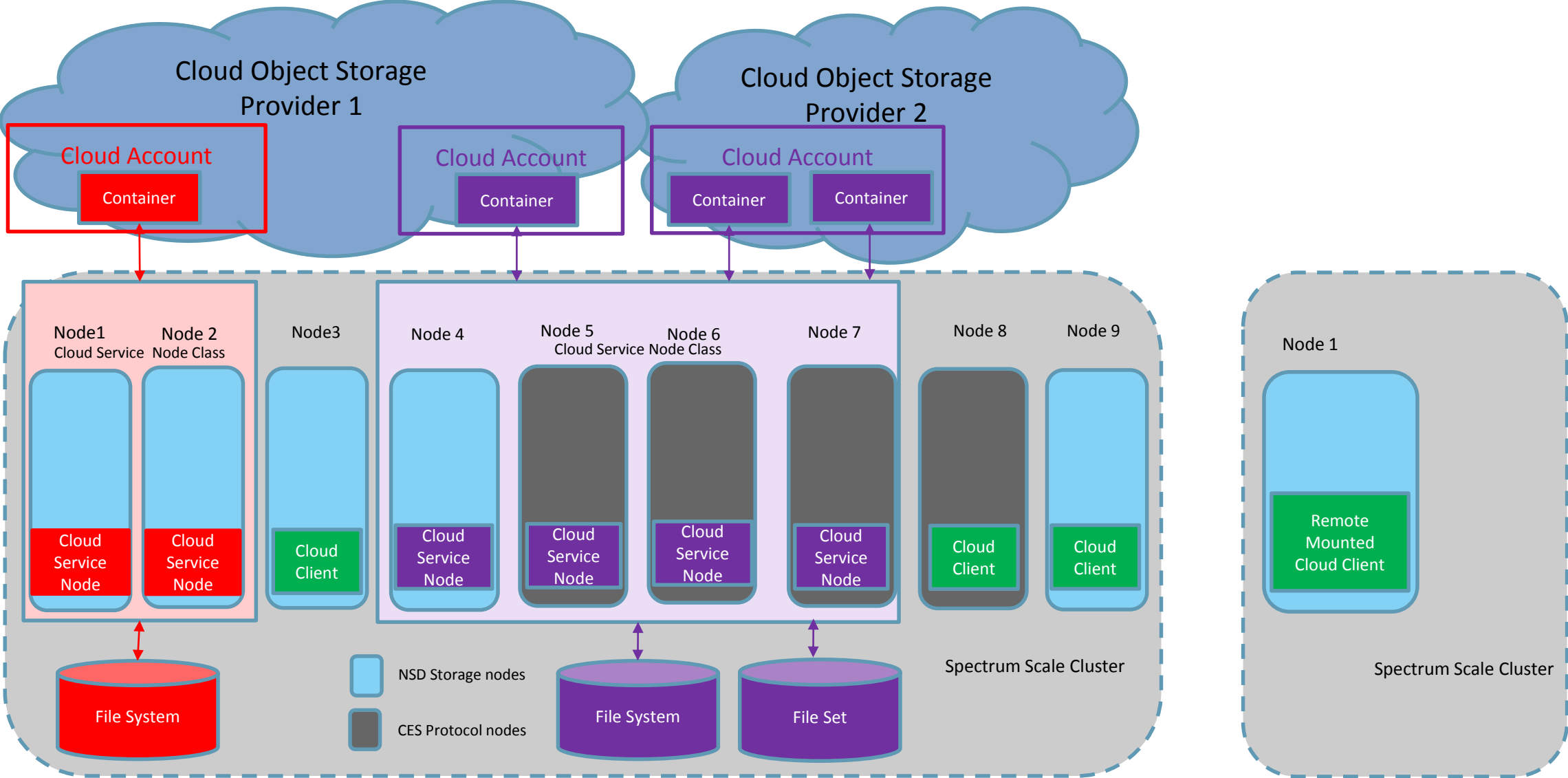
- WAN Proxy support
  - For outbound connections in proxy-controlled environments
- Premigration
  - Migrated files stay resident
  - Quick migrate when required
  - Fast access to small files
- WORM / SnapLock Support
  - Using Spectrum Scale Immutability and IBM Cloud Object Storage „Locked Vault“ features
  - Provides SEC-17a compliant WORM storage solution leveraging on-premises Cloud Object Storage



# Spectrum Scale TCT capabilities (5.0.0)

- **File set support**
  - File set support allows for more granular management of data movement to object storage
- **Multiple file system support**
  - The limit of 1 file system per Cloud Service Node group has been lifted
  - Scaling target: 128 file sets/file systems per Cloud Services Node Group
- **Multiple cloud accounts support**
  - Each filesystem or file set can support up to two Cloud Accounts
- **High Scalability using Container spill-over**
  - better support of large filesystems or file sets.
  - Scaling target: 200 containers per node group with each container spilling over at 100 million files
- **Remote mounted Client Support**
  - Remotely mounted clients can use TCT services on multiple remote clusters for transparent recall
  - More flexible ESS (separate cluster) support

# Spectrum Scale 5.0.0 Multi-Cloud TCT



# Spectrum Scale TCT capabilities (Next Release)

- **Greatly improved large file latency performance**
  - Expanded parallel threading to cover multi-threading within large individual files
- **Automated maintenance scheduling**
  - Most background maintenance activities are now automated
- **Scalable TCT DR service restoration**
  - SOBAR based back-ups allow restore service at around 1 billion files/day
  - Background automation to be added, outlook is 5.0.1
- **Ongoing service and support improvements**
  - Added latency metrics
  - No retries on errors that won't recover
  - Improved error messaging
  - Bottleneck detection

# Cloud Data Sharing



# Cloud Data Sharing



# IBM Spectrum Scale Cloud Data Sharing (cont.)

- IBM Cloud Object Storage serves as
  - Central data repository
  - Data distribution point
  - Data is accessible for native cloud applications through IBM COS S3 API
- Sharing can occur between object storage and many Spectrum Scale Clusters
- Shared Data may originate in either the cloud or Spectrum Scale
- Data may be moved or copied between Spectrum Scale clusters and object storage
- Efficient sharing mode: Special stubbed move available, so metadata only is stored on Spectrum Scale with data imported transparently when a file is requested
- One or more Spectrum Scale clusters can push to the cloud
- Spectrum Scale can pull data on demand

# Real-world Use Cases

# Autonomous driving measurement data

## Goal:

Effectively storing and accessing huge amounts of unstructured measurement data and videos

## Requirements:

NFS native data access or NFS via appliance

HTTP RESTful S3 API and SWIFT API access

20-40TB ingest per day

> 100 Million Objects, 10MB average object size

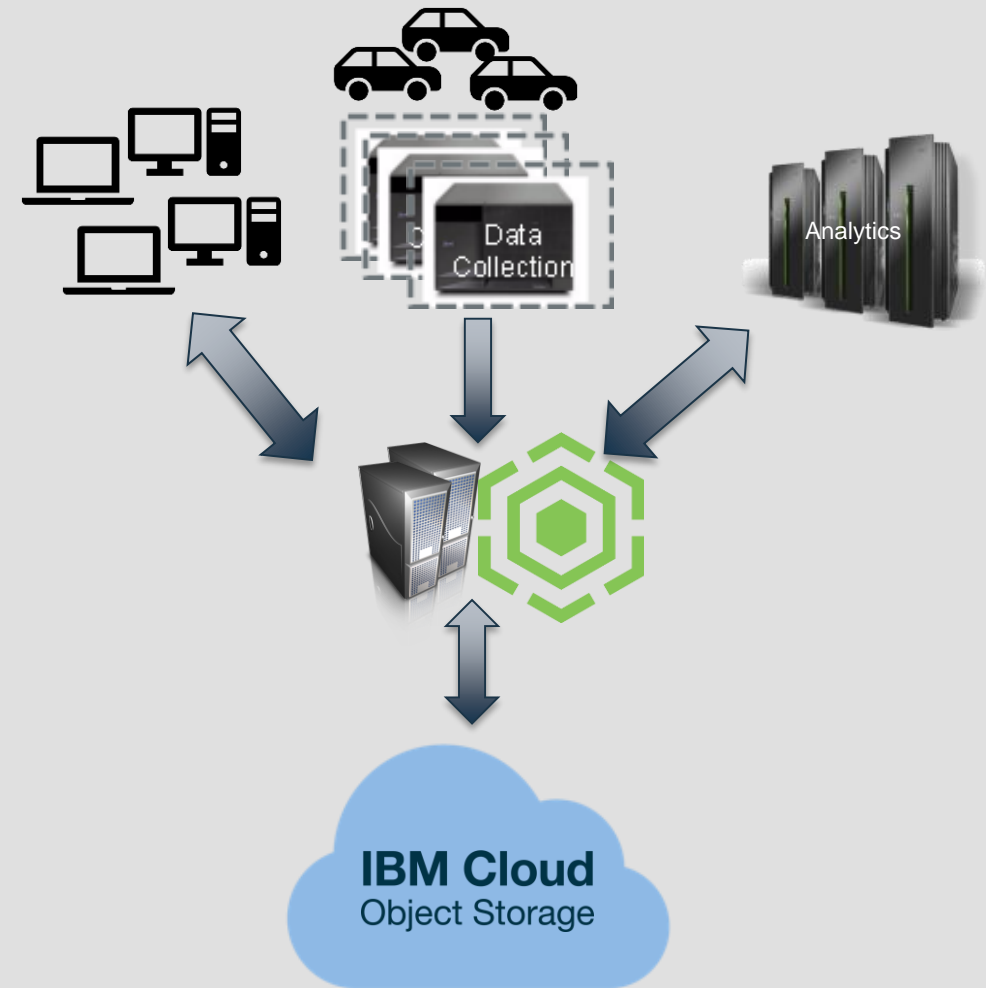
> 1000 Clients or client groups

Multi-tenancy, authorization and authentication

Encryption

- Data-in-transition encryption (at least HTTPS)
- Data-at-rest encryption (encrypted disks)

Interface to Analytics



# Autonomous driving measurement data (cont.)

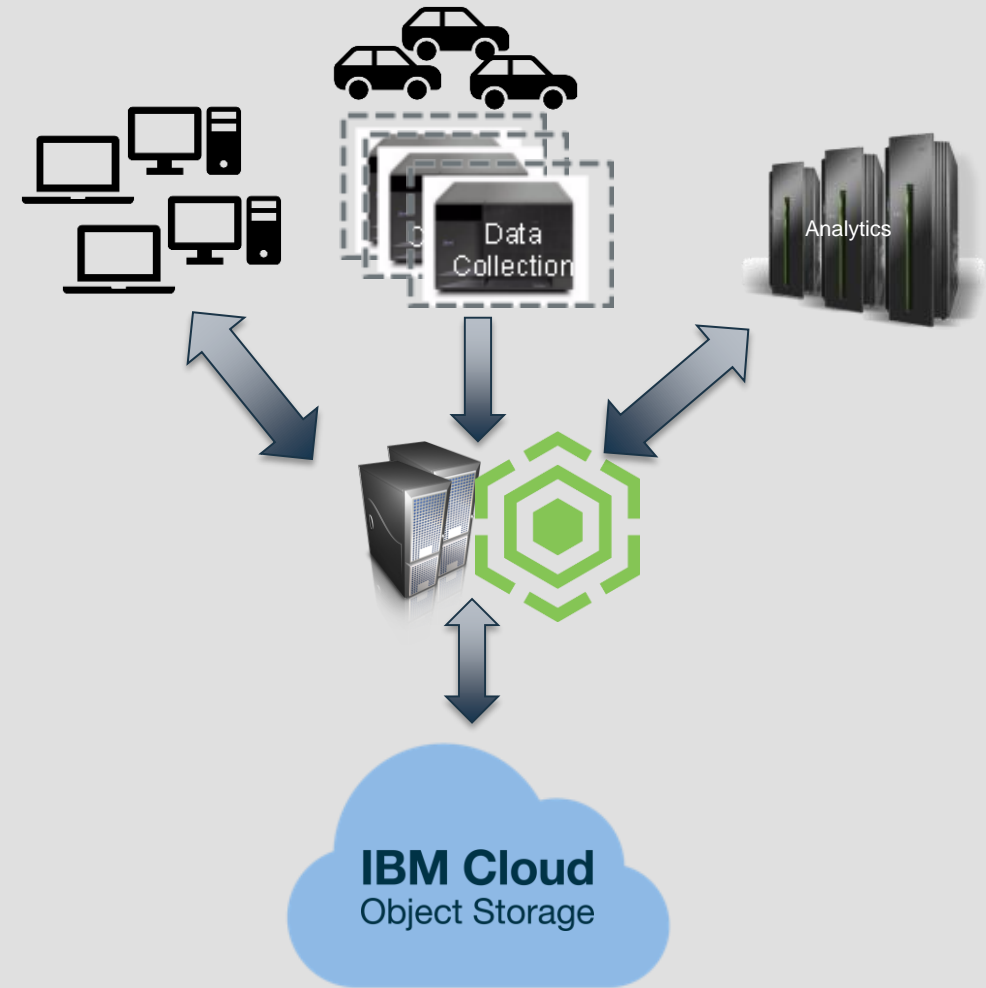
## Insights:

Required 800MB/s write throughput can be delivered by using ESS GL4

End-to-end encryption using HTTPS, Spectrum Scale at-rest and TCT Encryption with ISKLM, potentially NAS over IPSEC/VPN

Tenant isolation through multiple TCT node sets that map 1:1 to separate file systems

Separate NAS and TCT nodes for optimized resource usage



# Bodycam data

## Goal:

Providing archive for bodycam data with file access (unstructured, video)

## Requirements:

8-hour shift generates approx. 20GB of video data per camera

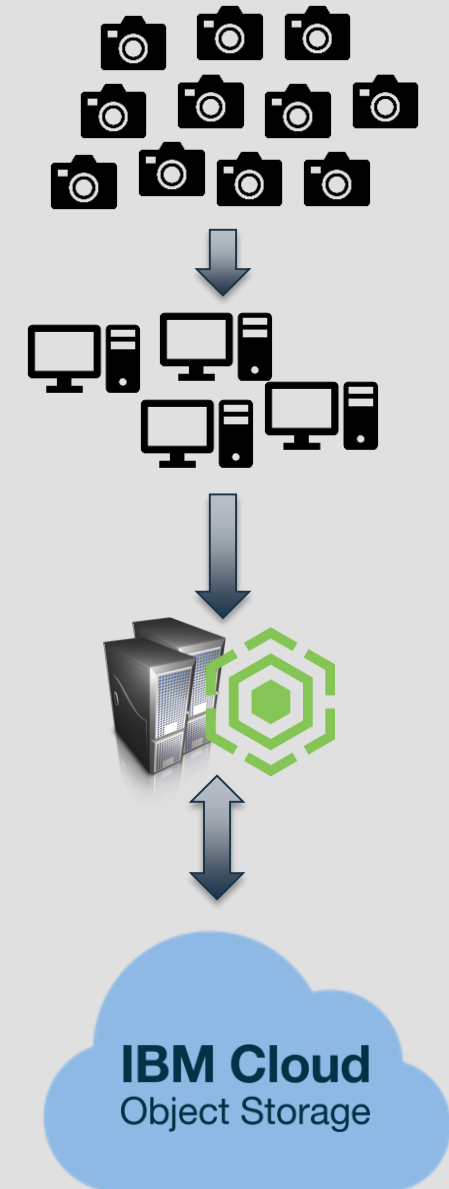
Legal requirement to keep the data for years  
- Varies by country/case

NAS protocols for data ingest

Secure authorization and authentication, encryption

## Insights:

Spectrum Scale stretched cluster combined with multi-site on-premises COS turned out to be perfect match



# Backup and file access private Cloud

**Goal:**

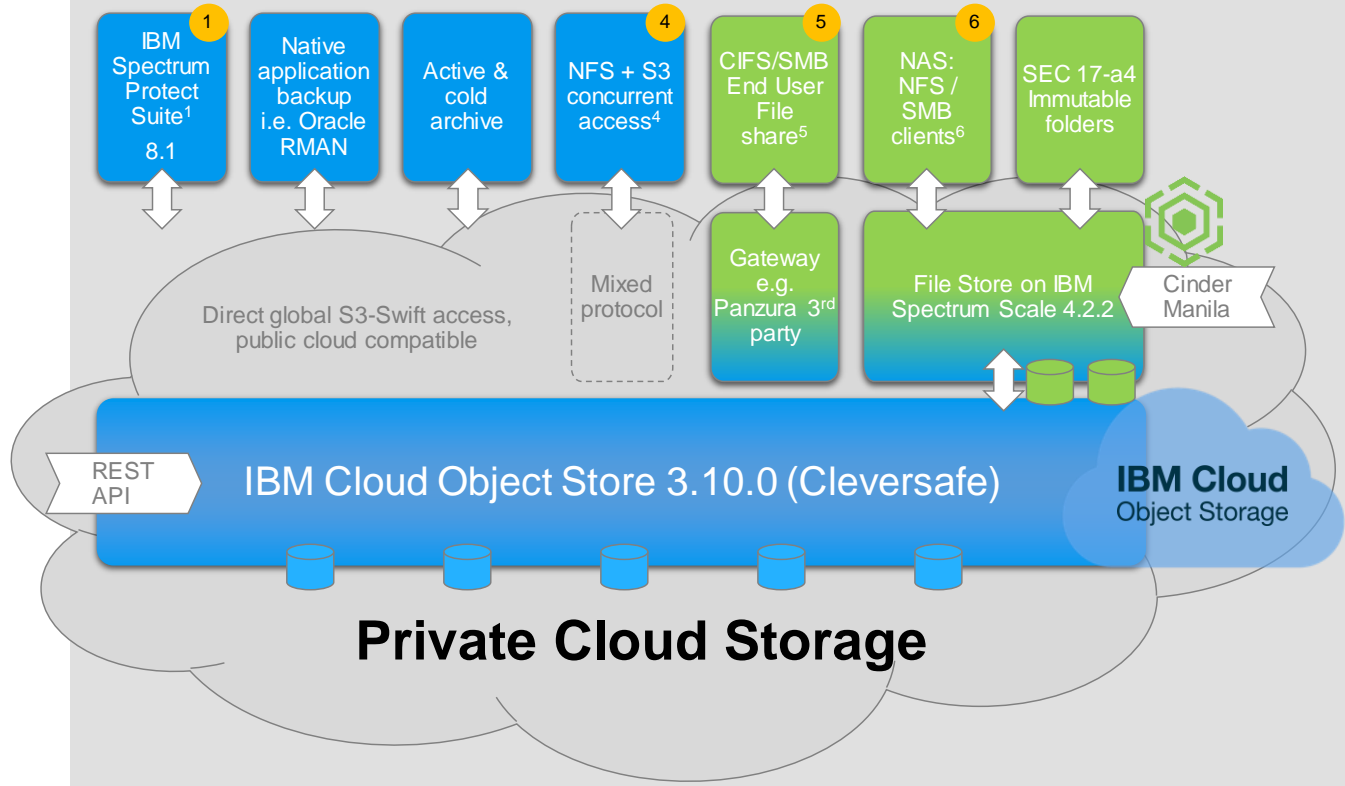
Transition to backup and file access cloud environment

**Requirements:**

- Move away from traditional backup
  - expensive, maintenance-intensive and slow for recovery operations according to the client
- Standardize and harmonize NAS and backup services
- Immutability for compliance requirements
- Option for native Object protocol access
- Capability to utilize public cloud

**Insights:**

Scale and COS combination strongly supports client roadmap towards a storage cloud



# StaaS provider leveraging public cloud

## Goal:

Leverage IBM COS as archival tier behind Spectrum Scale as part of Storage-as-a-Service offering

## Requirements:

Capability to utilize public cloud

## Insights:

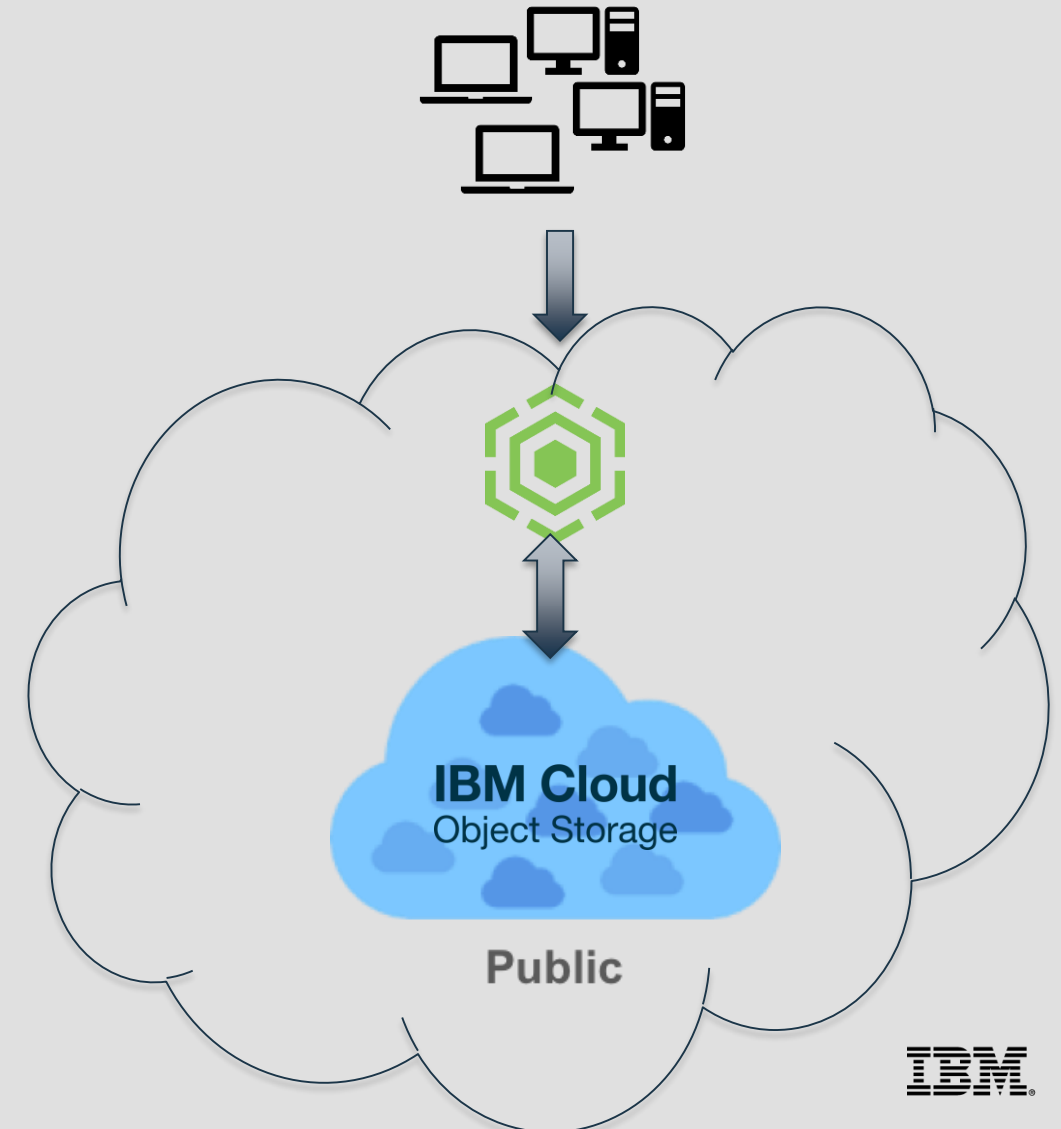
Apart from public cloud GB/month storage cost, need to take transfer costs into account

- COS on IBM Cloud: ~ 1ct per 1000 PUTs, similar per 10000 GETs

Every migrate/recall causes at least two PUT/GET requests (data and metadata)

Migrate uses multi-part upload (defaults to 100MB part size)

- Providers treat a single part as “single PUT”





# Log File Archiving

## Goal:

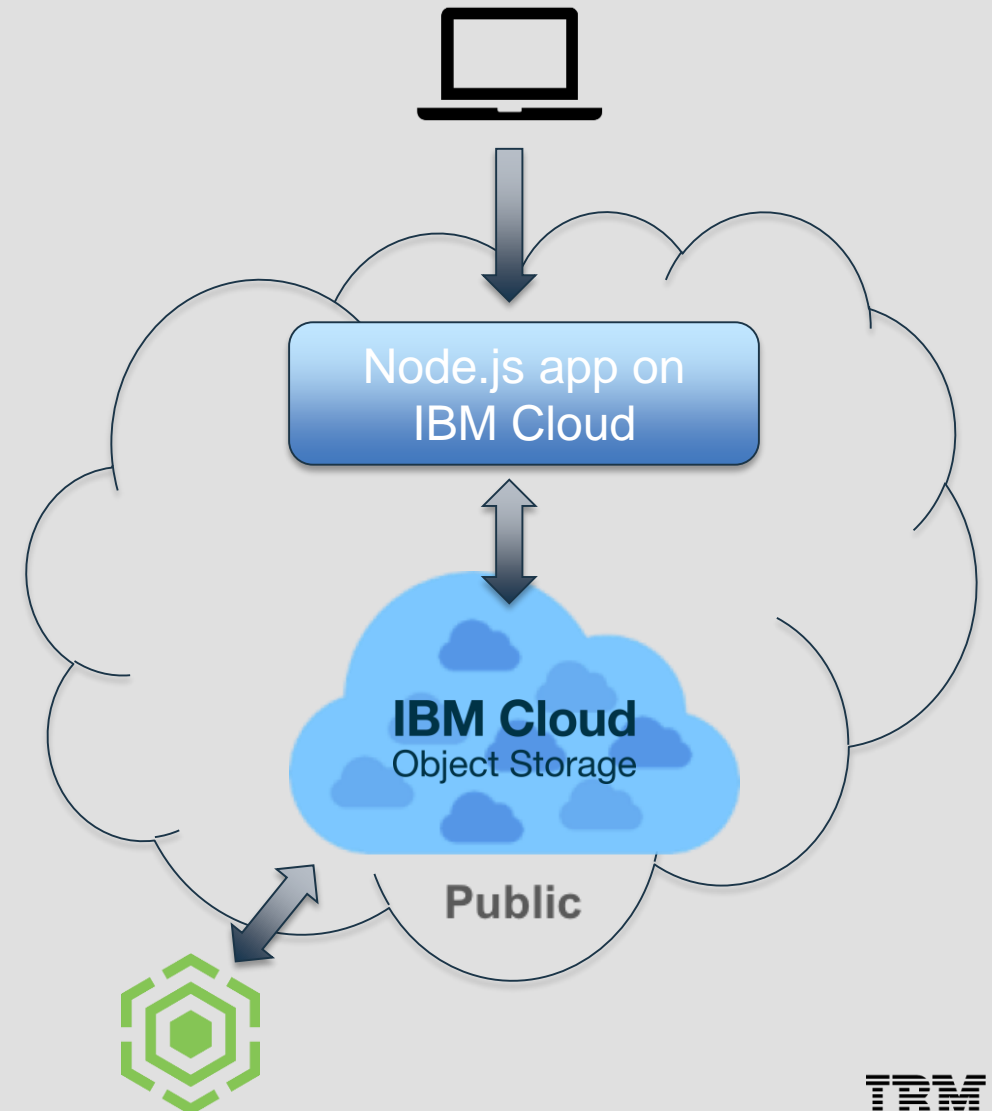
Archive log data, freeing up space on the primary Spectrum Scale Tier

## Requirements:

No stub files on Spectrum Scale namespace →  
Cloud Tiering is not an option

## Insights:

Export log data through Cloud Data Sharing  
Re-import for analysis or provide a cloud application for data access



# Video surveillance „anti-use-case“

## Goal:

Build System fast enough to handle numerous parallel data streams while cost-efficient to keep data for some period

## Requirements:

NFS ingest

600 cameras, 9Gbps sustained ingest

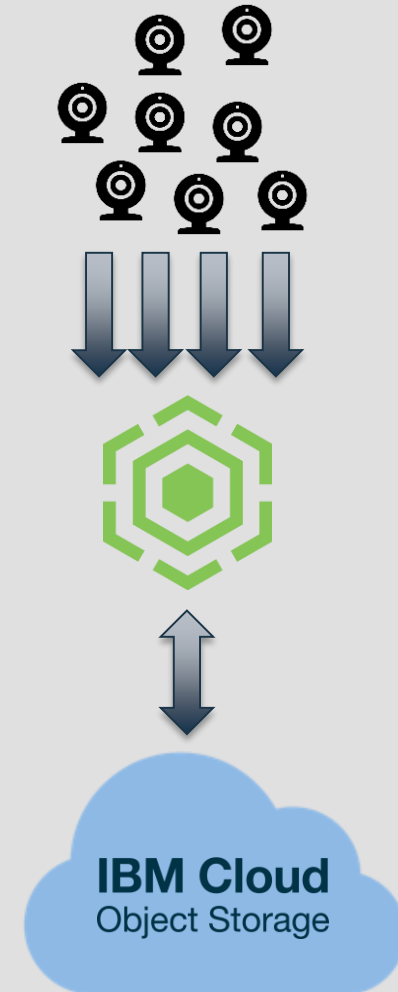
Average file size 5MB

## Insights:

With 2PB COS, data can be kept for 23 days

Reconcile deletions performed using single node/thread only  
- as of Spectrum Scale 4.2.2

80TB / 15M files need to be reconciled every day  
- This is the “showstopper” → recommended ESS-only solution



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# Session reference links

## Additional material

Redbook „Cloud Object Storage as a Service“  
<http://www.redbooks.ibm.com/redbooks.nsf/redbookabstracts/sg248385.html?Open>

Redpaper „Enabling Hybrid Cloud Storage for IBM Spectrum Scale Using Transparent Cloud Tiering“  
<http://www.redbooks.ibm.com/redpieces/abstracts/redp5411.html>

Redpaper „Cloud Data Sharing with IBM Spectrum Scale“  
<http://www.redbooks.ibm.com/redpieces/abstracts/redp5419.html>

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