

# IBM Spectrum Scale Transparent Cloud Tiering

Integration with Object Storage

April 2019

# Agenda

- Spectrum Scale Transparent Cloud Tiering introduction
  - Tiering
  - Sharing
- Real-world use cases
  - Autonomous driving measurement data
  - Bodycam recordings
  - Tape backup replacement
  - SaaS provider leveraging public cloud
  - Video surveillance „anti-use-case“
- Outlook for 2H2019 features

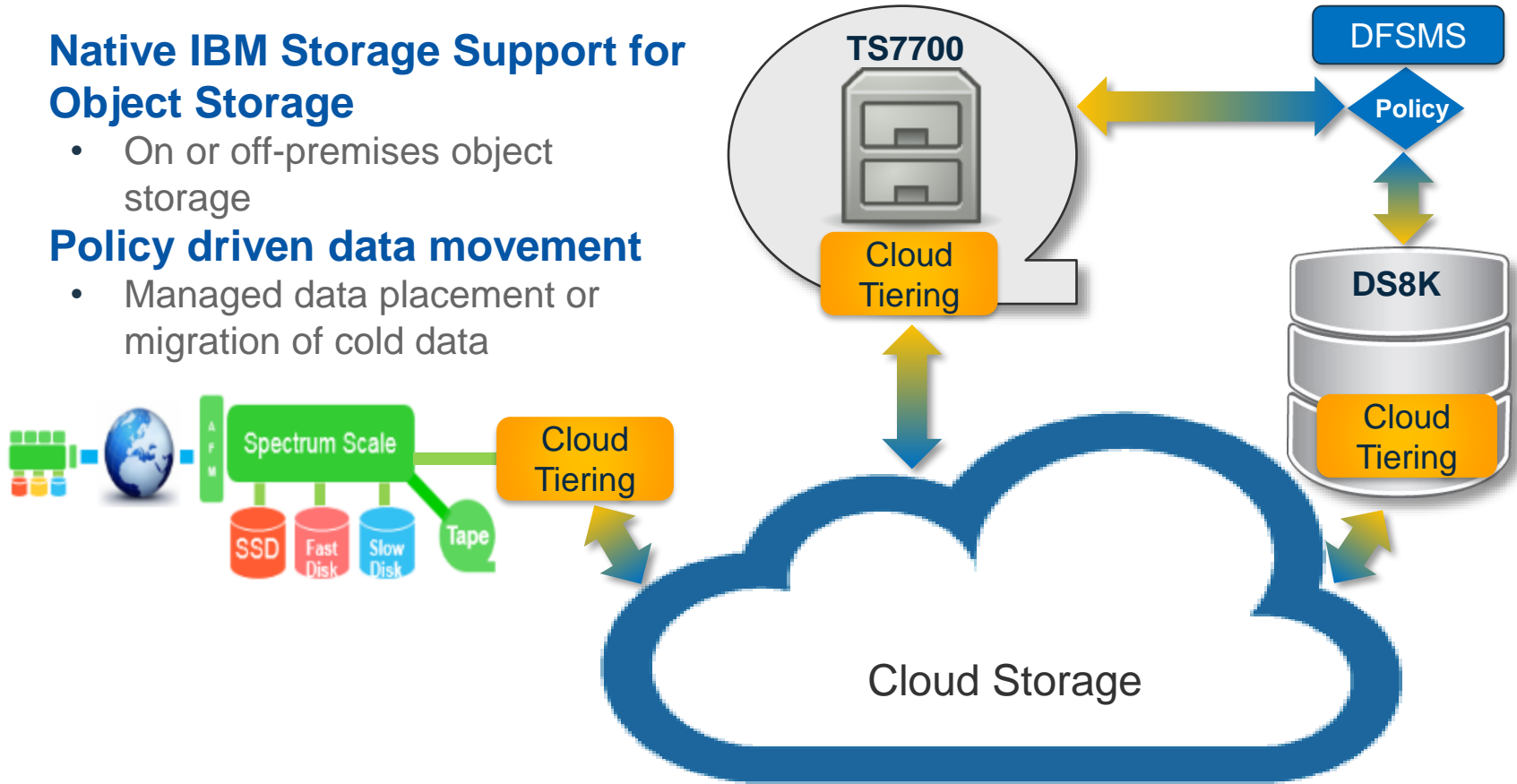
# Transparent Cloud Tiering Is Used Across IBM Storage

## Native IBM Storage Support for Object Storage

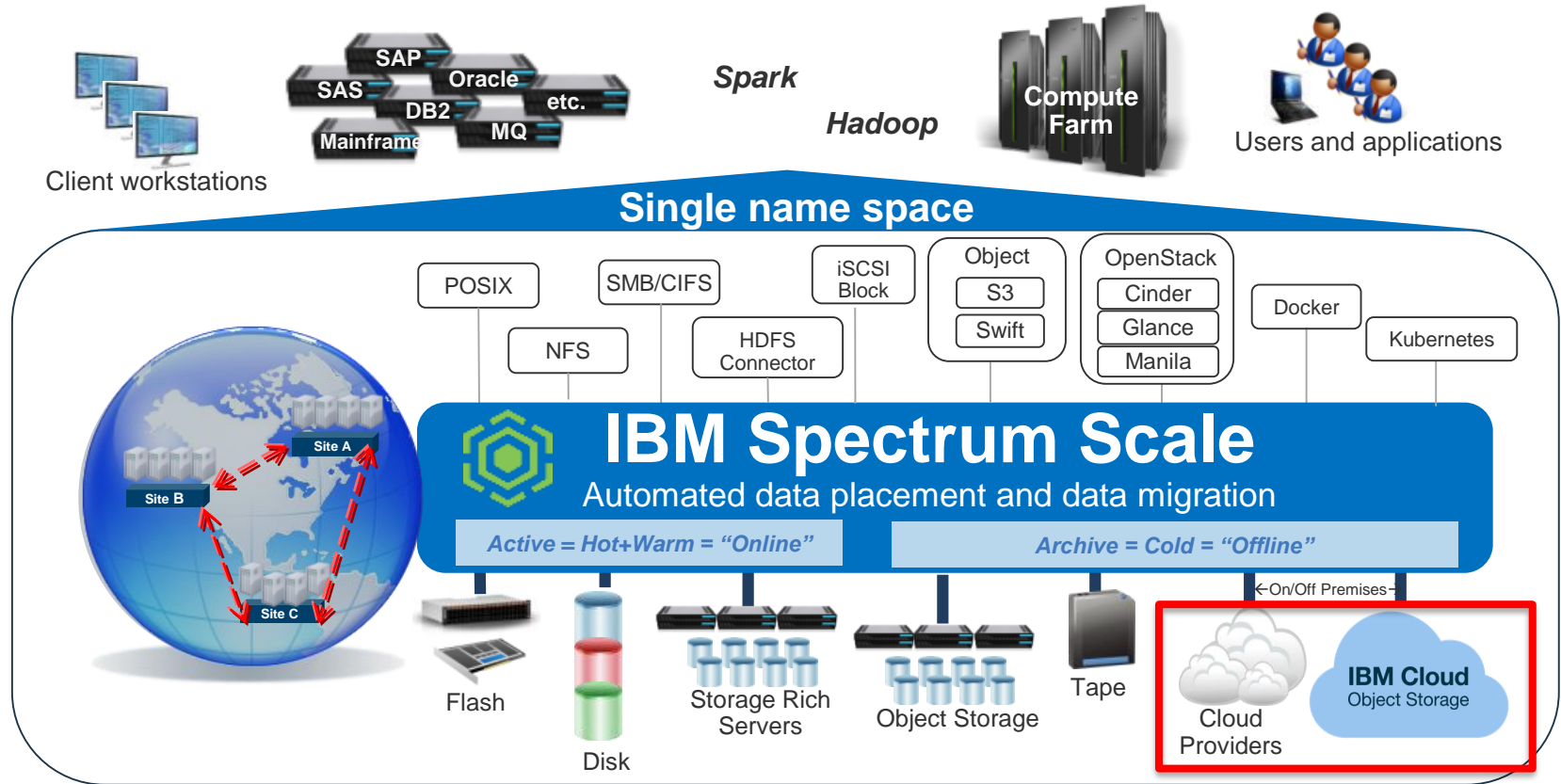
- On or off-premises object storage

## Policy driven data movement

- Managed data placement or migration of cold data

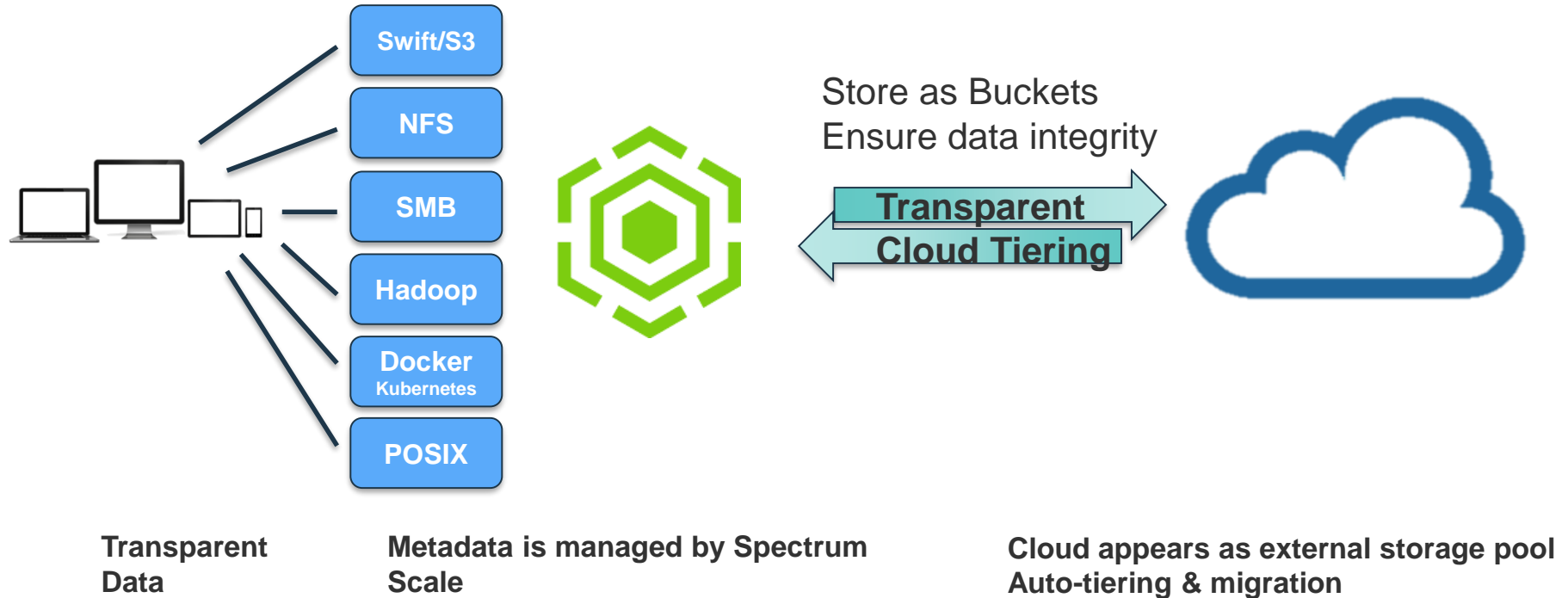


# IBM Spectrum Scale – scalable file and object store



# Spectrum Scale Transparent Cloud Tiering Introduction

# Spectrum Scale Transparent Cloud Tiering (TCT)



# Protocol mapping vs. Transparent Cloud Tiering

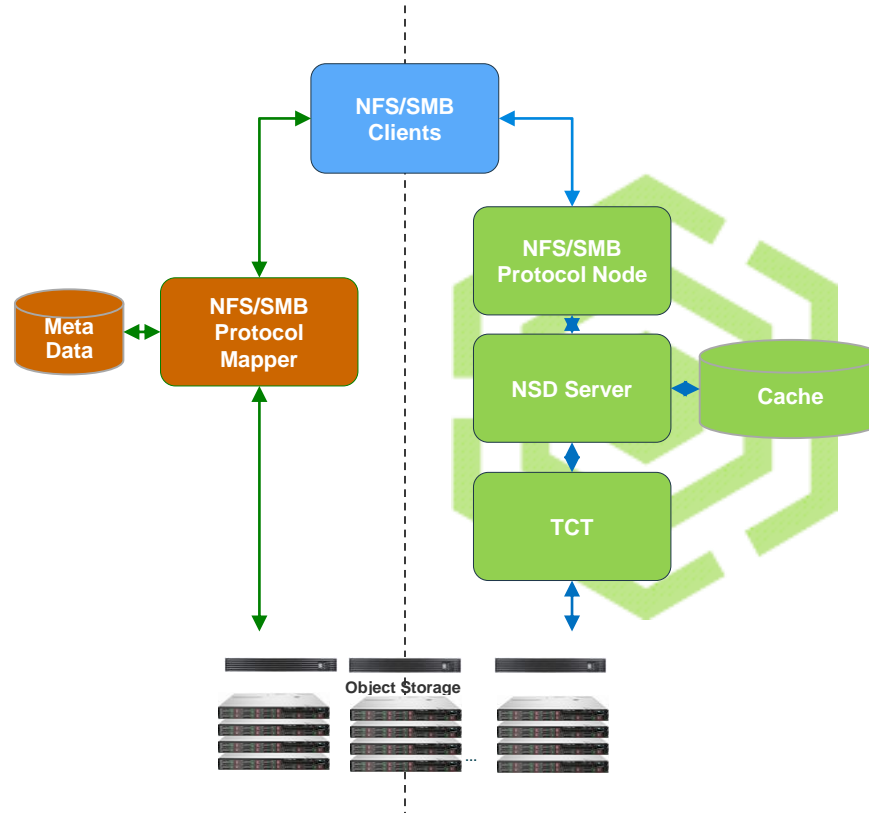
## Protocol Mapping

### 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
    - Amazon S3
    - Azure
  - 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



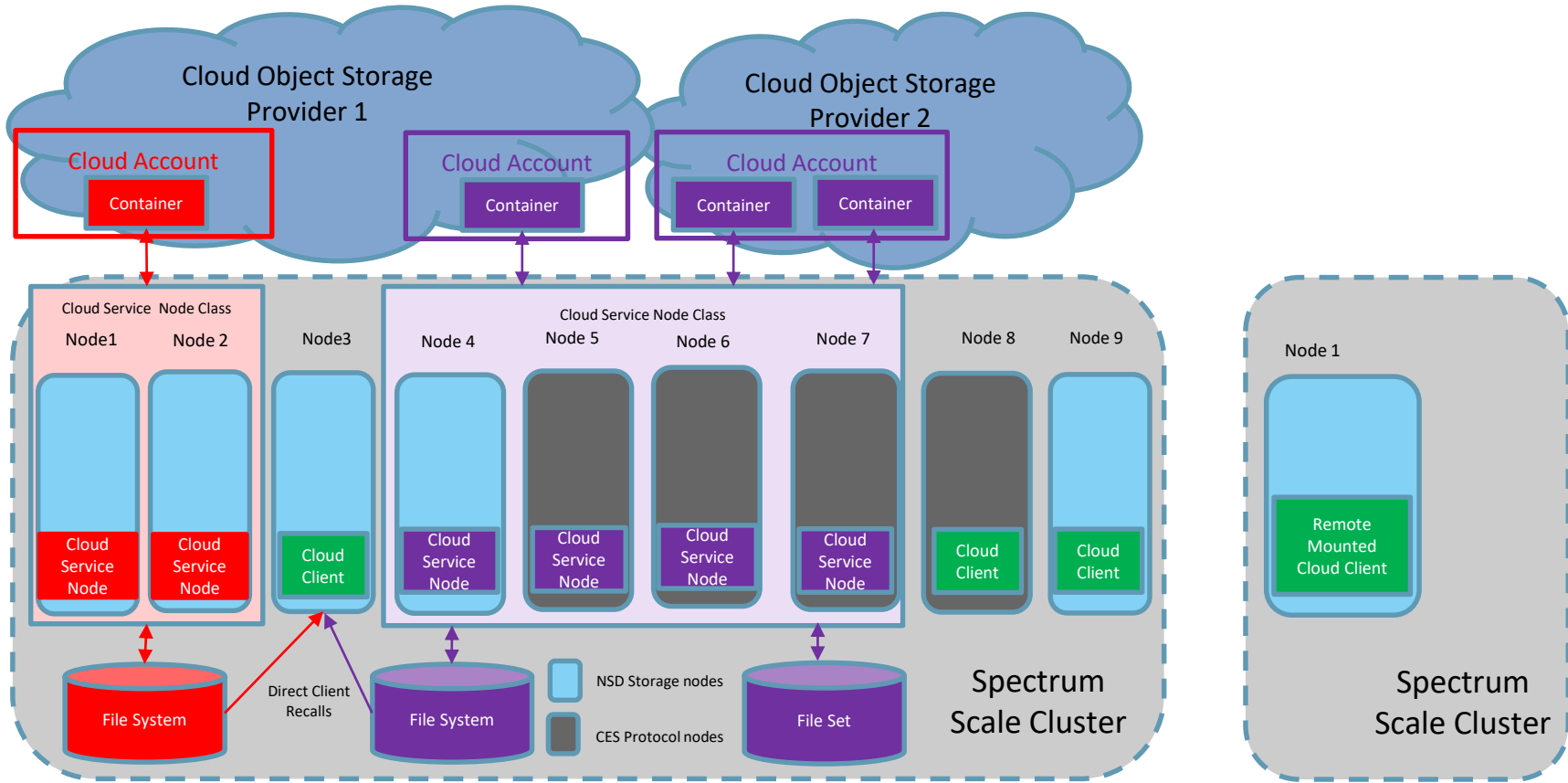


# Recommended Environment for Spectrum Scale TCT

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

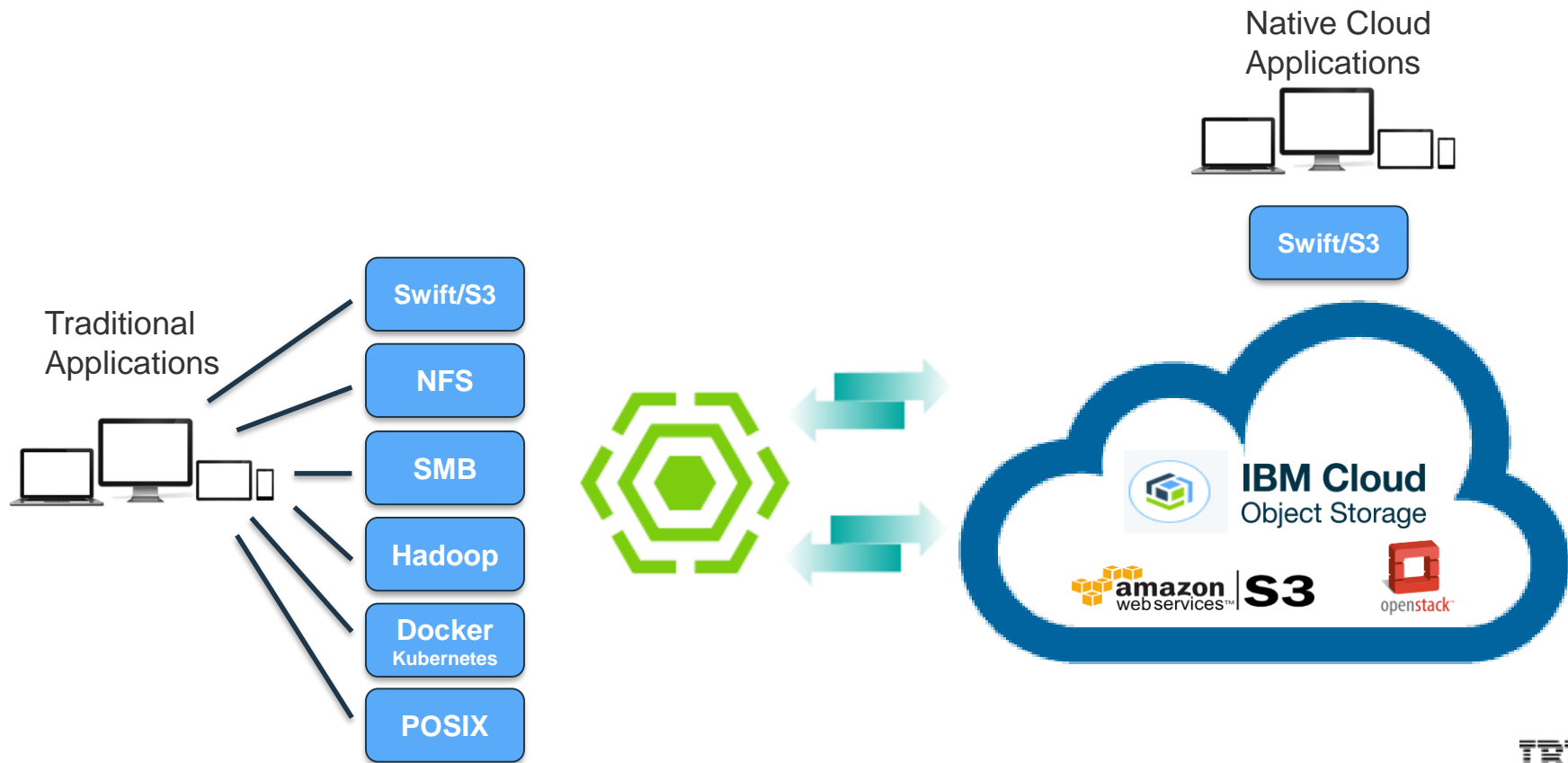


# Transparent Cloud Tiering Example



# 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
- Move or copy is supported
- Control movement to the cloud using the Spectrum Scale policy
- Spectrum Scale can pull data on demand

# Real-world Use Cases

# 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

**Robust:** Tolerance for full site loss with SOBAR based site failover taking on just hours

**Efficient:** Low 1.4-1.6 x overhead site distributed erasure coding

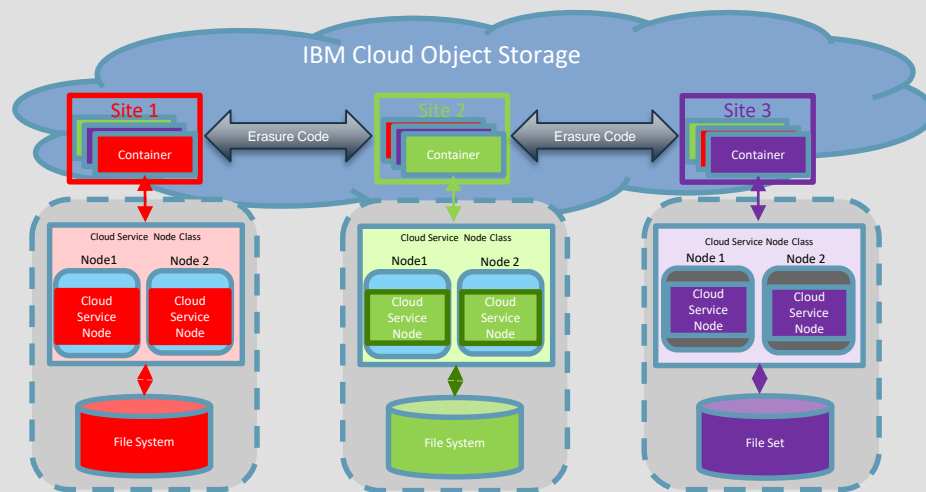
**Retention Compliant:** Immutability as needed

Option for native Object protocol access

Capability to utilize public cloud

## Insights:

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



# 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

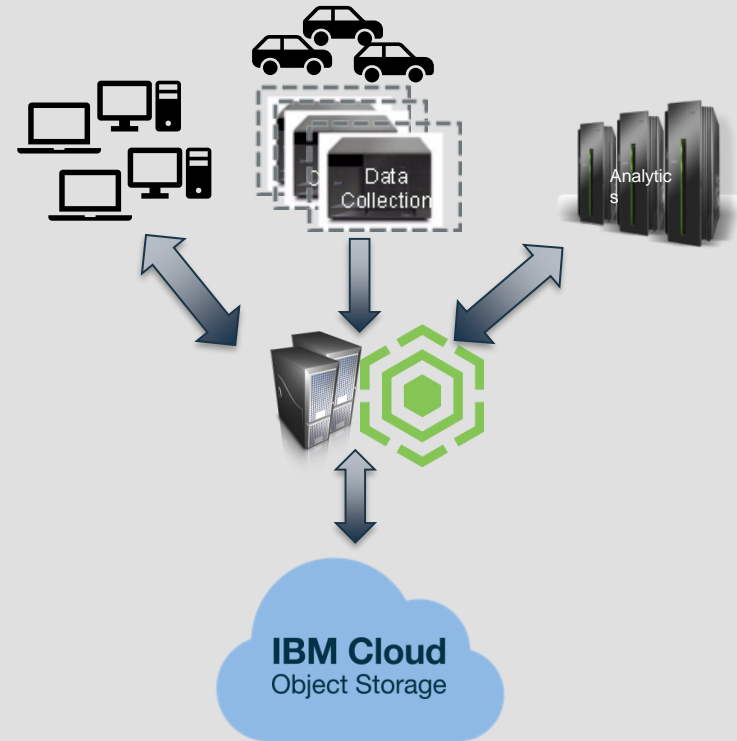
> 1000 Clients or client groups

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.)

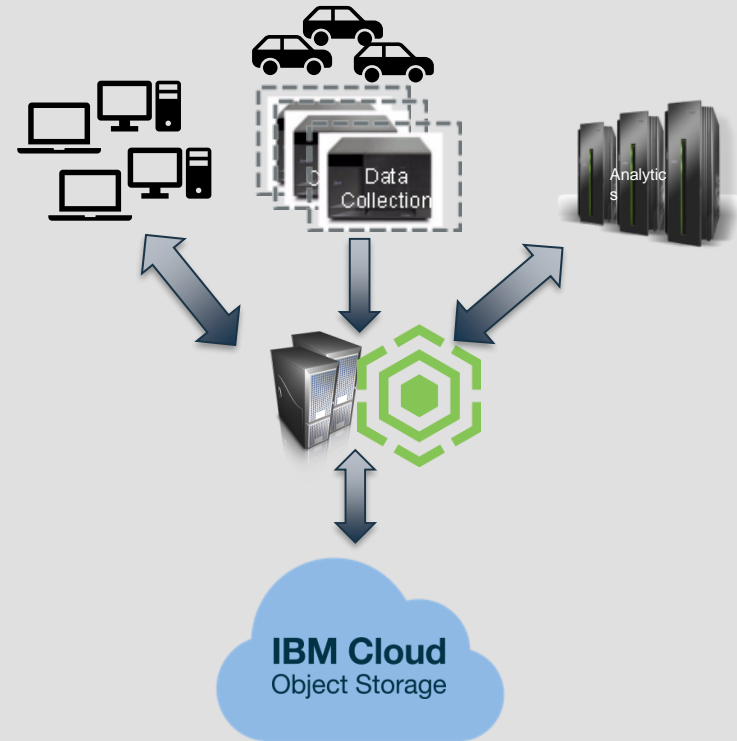
## Insights:

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

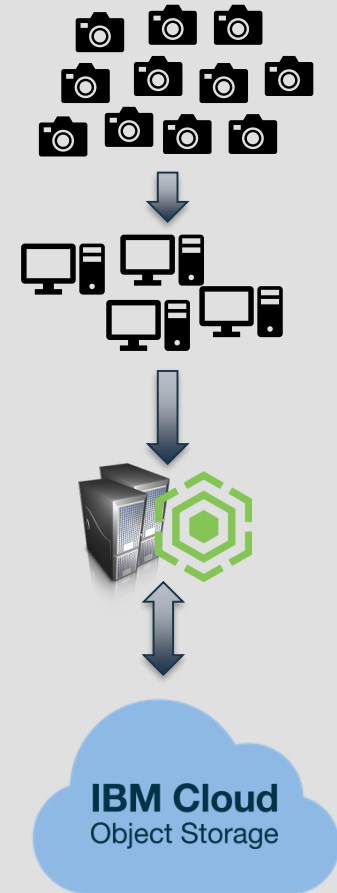
Legal requirement to keep the data for years  
- Varies by country/case

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



# 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:

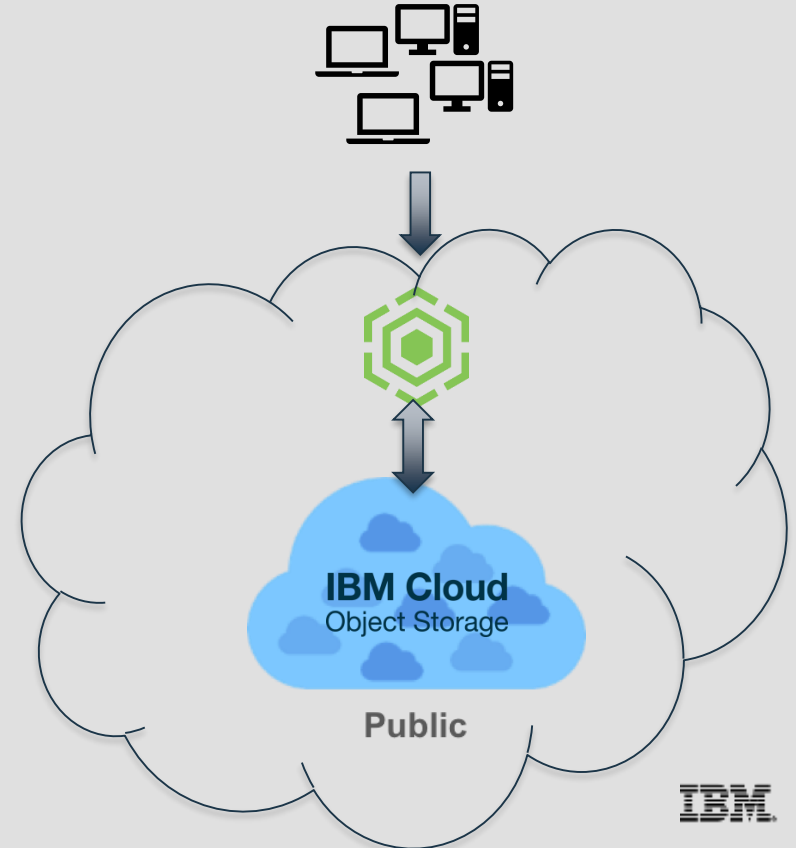
Apart from public cloud GB/month storage cost, need to take transfer costs into account

- 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:

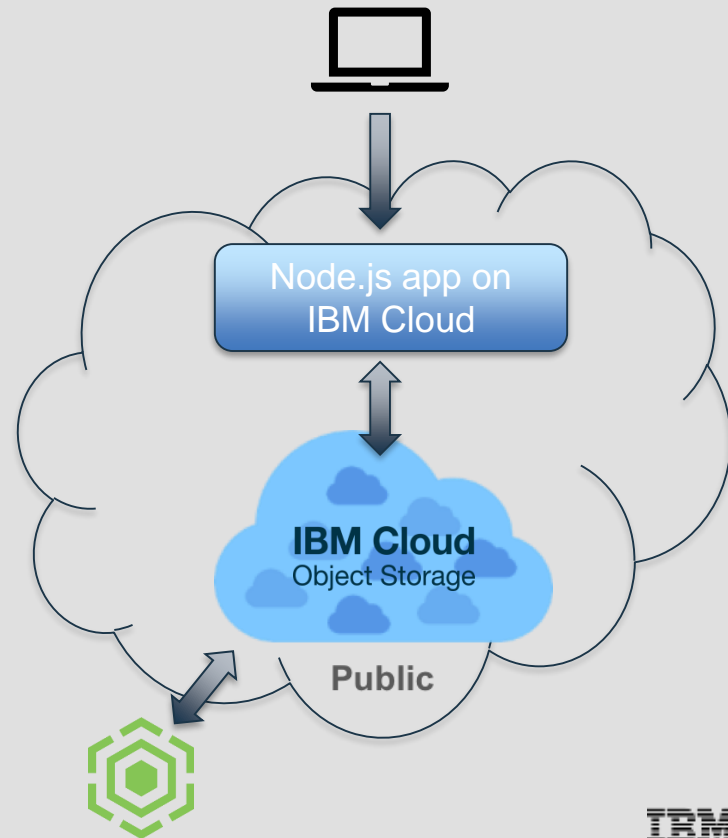
Archive log data, freeing up space on the primary Spectrum Scale Tier

## 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

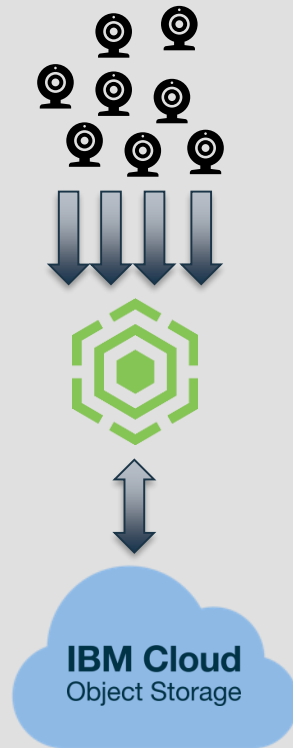
Average file size 5MB

## 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



# Legal Disclaimer

IBM's statements regarding its plans, directions, and intent are subject to change or withdrawal without notice at IBM's sole discretion. Information regarding potential future products is intended to outline our general product direction and it should not be relied on in making a purchasing decision. The information mentioned regarding potential future products is not a commitment, promise, or legal obligation to deliver any material, code or functionality. Information about potential future products may not be incorporated into any contract. The development, release, and timing of any future features or functionality described for our products remains at our sole discretion.

# Summary and call to action

Consider Spectrum Scale Transparent Cloud Tiering for matching use cases

- Active Archive
- Analytics

Extend Spectrum Scale to public cloud or IBM Cloud Object Storage System

- Transparent to end-users using Spectrum Scale
- Enhancing Object Storage choice
  - Spectrum Scale as High-Performance, unified file and object storage
  - IBM Cloud Object Storage as cost-optimized, scalable object storage

We need your feedback for the multi-site support!

Thank you!



# Notice and disclaimers

- Copyright © 2018 by International Business Machines Corporation (IBM). No part of this document may be reproduced or transmitted in any form without written permission from IBM.
- **U.S. Government Users Restricted Rights — use, duplication or disclosure restricted by GSA ADP Schedule Contract with IBM.**
- Information in these presentations (including information relating to products that have not yet been announced by IBM) has been reviewed for accuracy as of the date of initial publication and could include unintentional technical or typographical errors. IBM shall have no responsibility to update this information. **This document is distributed “as is” without any warranty, either express or implied. In no event shall IBM be liable for any damage arising from the use of this information, including but not limited to, loss of data, business interruption, loss of profit or loss of opportunity.** IBM products and services are warranted according to the terms and conditions of the agreements under which they are provided.
- IBM products are manufactured from new parts or new and used parts. In some cases, a product may not be new and may have been previously installed. Regardless, our warranty terms apply.”
- **Any statements regarding IBM's future direction, intent or product plans are subject to change or withdrawal without notice.**
- Performance data contained herein was generally obtained in a controlled, isolated environments. Customer examples are presented as illustrations of how those customers have used IBM products and the results they may have achieved. Actual performance, cost, savings or other results in other operating environments may vary.
- References in this document to IBM products, programs, or services does not imply that IBM intends to make such products, programs or services available in all countries in which IBM operates or does business.
- Workshops, sessions and associated materials may have been prepared by independent session speakers, and do not necessarily reflect the views of IBM. All materials and discussions are provided for informational purposes only, and are neither intended to, nor shall constitute legal or other guidance or advice to any individual participant or their specific situation.
- It is the customer's responsibility to insure its own compliance with legal requirements and to obtain advice of competent legal counsel as to the identification and interpretation of any relevant laws and regulatory requirements that may affect the customer's business and any actions the customer may need to take to comply with such laws. IBM does not provide legal advice or represent or warrant that its services or products will ensure that the customer is in compliance with any law.

# Notice and disclaimers (continued)

Information concerning non-IBM products was obtained from the suppliers of those products, their published announcements or other publicly available sources. IBM has not tested those products in connection with this publication and cannot confirm the accuracy of performance, compatibility or any other claims related to non-IBM products. Questions on the capabilities of non-IBM products should be addressed to the suppliers of those products. IBM does not warrant the quality of any third-party products, or the ability of any such third-party products to interoperate with IBM's products. **IBM expressly disclaims all warranties, expressed or implied, including but not limited to, the implied warranties of merchantability and fitness for a particular, purpose.**

The provision of the information contained herein is not intended to, and does not, grant any right or license under any IBM patents, copyrights, trademarks or other intellectual property right.

IBM, the IBM logo, ibm.com, AIX, BigInsights, Bluemix, CICS, Easy Tier, FlashCopy, FlashSystem, GDPS, GPFS, Guardium, HyperSwap, IBM Cloud Managed Services, IBM Elastic Storage, IBM FlashCore, IBM FlashSystem, IBM MobileFirst, IBM Power Systems, IBM PureSystems, IBM Spectrum, IBM Spectrum Accelerate, IBM Spectrum Archive, IBM Spectrum Control, IBM Spectrum Protect, IBM Spectrum Scale, IBM Spectrum Storage, IBM Spectrum Virtualize, IBM Watson, IBM z Systems, IBM z13, IMS, InfoSphere, Linear Tape File System, OMEGAMON, OpenPower, Parallel Sysplex, Power, POWER, POWER4, POWER7, POWER8, Power Series, Power Systems, Power Systems Software, PowerHA, PowerLinux, PowerVM, PureApplica- tion, RACF, Real-time Compression, Redbooks, RMF, SPSS, Storwize, Symphony, SystemMirror, System Storage, Tivoli, WebSphere, XIV, z Systems, z/OS, z/VM, z/VSE, zEnterprise and zSecure are trademarks of International Business Machines Corporation, registered in many jurisdictions worldwide. Other product and service names might be trademarks of IBM or other companies. A current list of IBM trademarks is available on the Web at "Copyright and trademark information" at: [www.ibm.com/legal/copytrade.shtml](http://www.ibm.com/legal/copytrade.shtml).

Linux is a registered trademark of Linus Torvalds in the United States, other countries, or both. Java and all Java-based trademarks and logos are trademarks or registered trademarks of Oracle and/or its affiliates.

# 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>

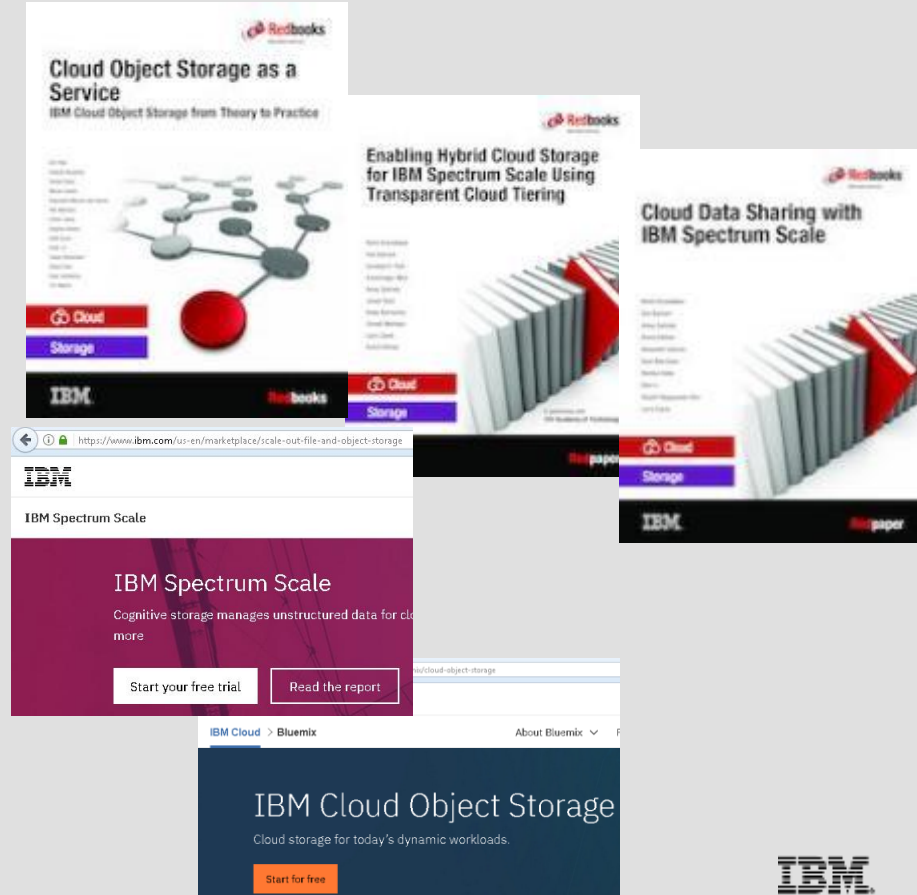
## Try yourself

Get free IBM Cloud Object Storage trial

<https://www.ibm.com/cloud-computing/bluemix/cloud-object-storage>

Get free IBM Spectrum Scale trial

<http://www-03.ibm.com/systems/storage/spectrum/scale/trial.html>



# TCT Features By Release

## 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 TCT capabilities (5.0.1)

- **Greatly improved large file recall 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 next Scale release
- **Ongoing service and support improvements**
  - Added latency metrics
  - No retries on errors that won't recover
  - Improved error messaging
  - Bottleneck detection

## Spectrum Scale TCT capabilities (5.0.3)

- **Direct Client transparent recall support**
  - Any and all clients can be configured to transfer the data for transparent recall requests
- **Azure storage support**
- **zLinux Spectrum Scale Cluster support**
- **Automatic container spillover**
  - When a tiering container reaches the 100 million threshold a new container is automatically created and used
- **Security: default SigV4 support**
  - Move from jclouds to the Amazon SDK for S3 and S3 compatible device support
- **Simplified Backup / Restore**
  - The SOBAR script has been improved for a streamlined backup and restore of TCT
- **Quota support script**
  - Quota support script is available that allows for periodic quota reports by User / Filesystem

# Direct Client Transparent Recall Explanation

## Direct Recall Key Benefits

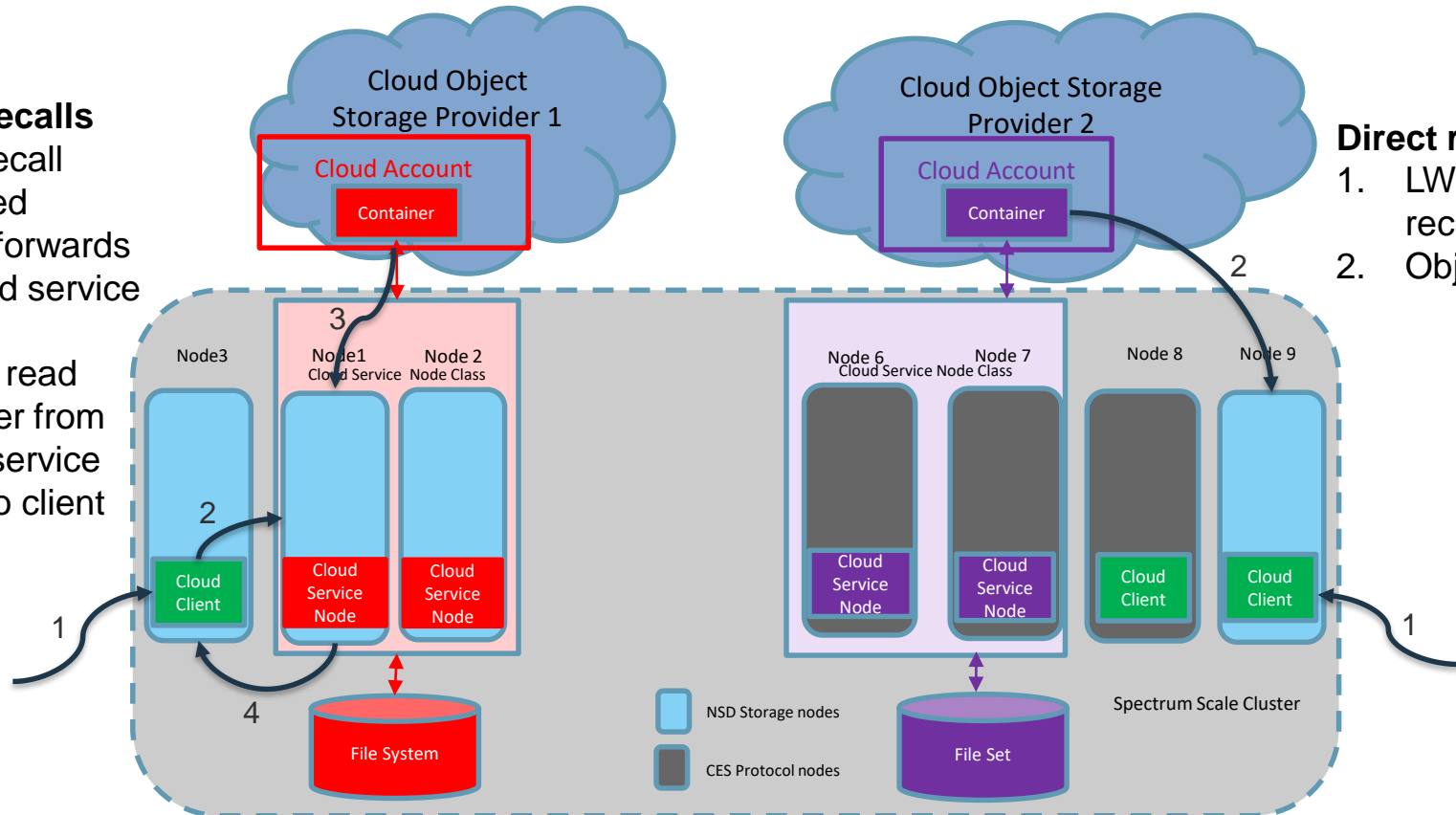
- Efficient
- Performance scales with cluster size

### Gateway recalls

1. LWE recall received
2. Client forwards to cloud service node
3. Object read
4. Transfer from cloud service node to client node

### Direct recalls

1. LWE recall received
2. Object read



What's next

# Spectrum Scale TCT capabilities next release outlook

- **Dynamic Amazon Region support**
  - New Amazon regions supported as soon as they come online – no need to get new releases of TCT to get support for new regions
- **Watch folder Kafka events**
  - Allows immediate action on TCT using a listener for Watch folder generated Kafka events
    - For immediate archival when tiering
    - For immediate copying when sharing