

# Data Replication and Migration from Ceph RGW to Cloud

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# Agenda

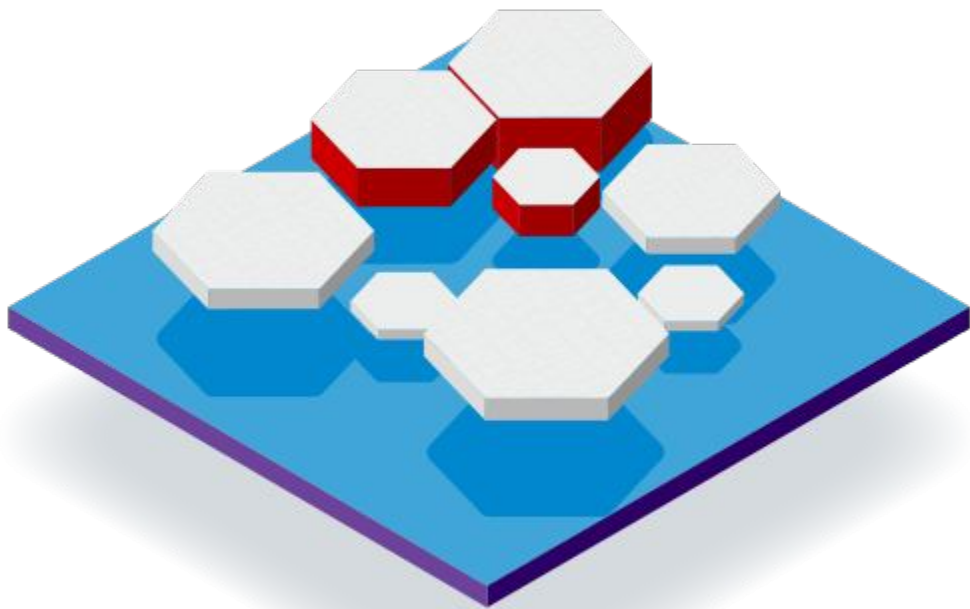
- Brief Introduction to Ceph
- Ceph Object Gateway (RGW)
- Hybrid Cloud & its Data movement
- Ceph RGW & Public Cloud integration
  - Cloud Sync (Data Replication)
  - Cloud Transition (Data Migration)
- Future work

# Ceph

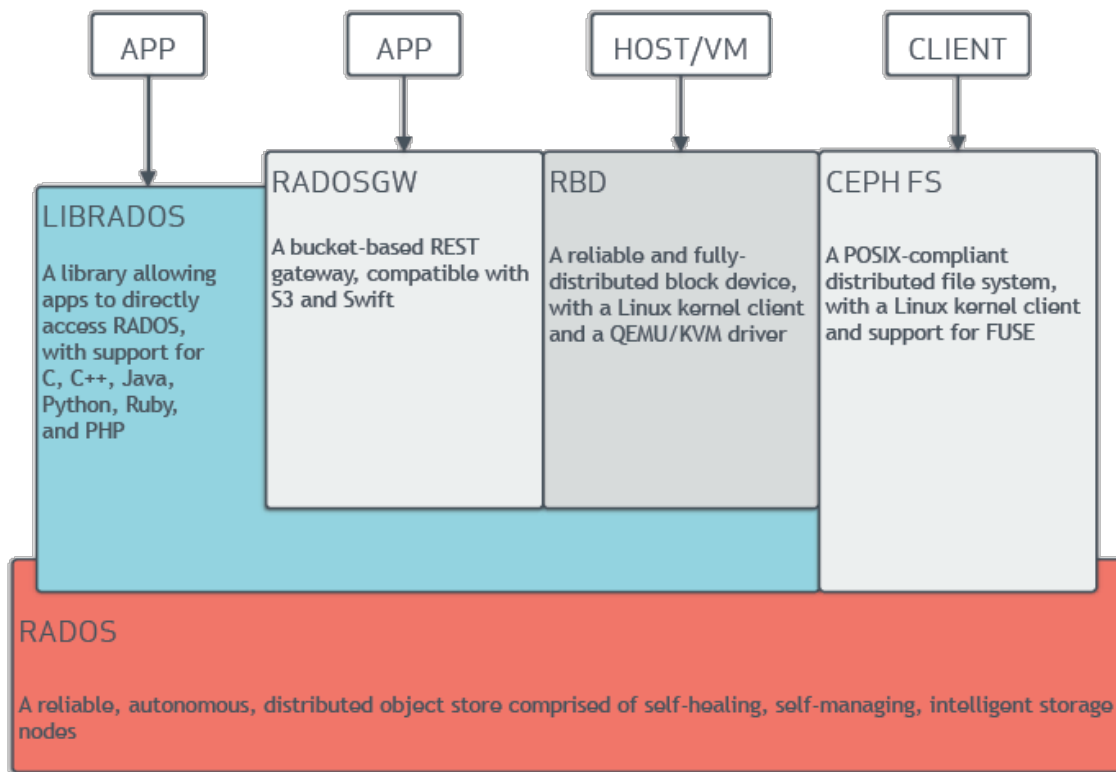


# Ceph - A platform for petabyte-scale storage

Ceph is an open, massively scalable storage solution for modern workloads like cloud infrastructure, data analytics, media repositories, and backup and restore.



# Ceph Architecture

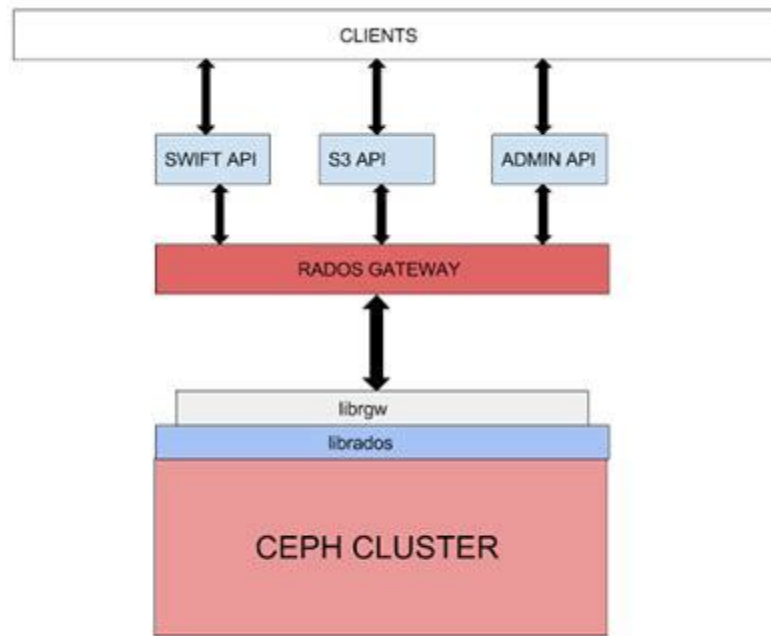


# Ceph RGW



# Ceph Object Gateway (RadosGW)

- Object storage interface
- provides RESTful HTTP API to store objects and metadata
- built on top of librados
- S3 and Swift compatible API
- Unified namespace



# Hybrid Cloud

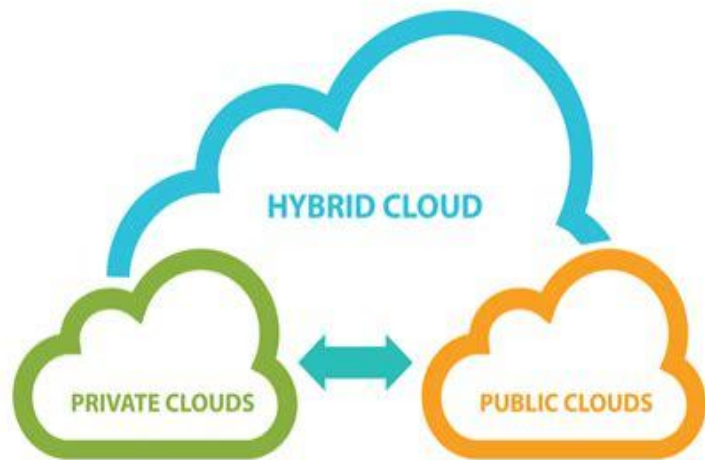
Data movement challenges





# Hybrid Cloud

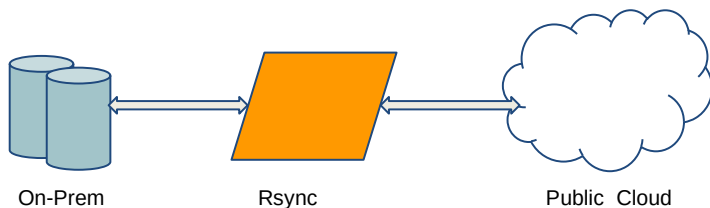
- unifies public cloud, private cloud and on-premises infrastructure
- creates single, unified and flexible distributed computing environment
- provide a way to leverage the advantages of the cloud while maintaining on-premises infrastructure for the most critical processes or most sensitive data.
- Efficient compared to public cloud or private cloud alone but biggest challenge is
  - the movement of data within the hybrid cloud.



# Data movement challenges in hybrid cloud

Using DIY data transfer solution (eg., Rsync, Rclone, s3cmd, AWS CLI)

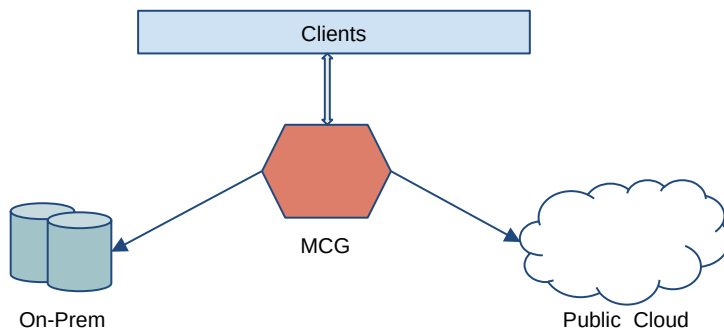
- lot of manual work
- lacks monitoring and error detection abilities
- doesn't support incremental synchronization
- cost and time impacts



# Data movement challenges in hybrid cloud

## Using Multi-Cloud Gateway

- Clients have to connect to MCG (even On Premises)
  - Eg., Noobaa, Zenko
- Data Redundancy & Management Overhead
- Low I/O throughput
- Cannot leverage the full capabilities of On-Prem RGW server
- Not easy to detect and debug errors



# Integrating Ceph RGW with Public Cloud

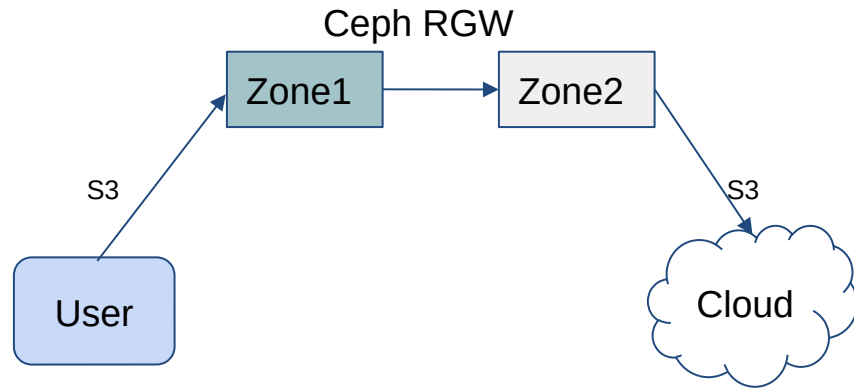
- Using Cloud Sync & Cloud Transition
  - For Data replication & Migration
- a full-fledged service
- secure, reliable, efficient and fast data transfers
- Can transfer to multiple endpoints
- Incremental transfer
- Parallel processing
- Tools to monitor status and detect errors

# Cloud Sync



# Cloud Sync

- A SYNC MODULE
  - Built atop of multisite framework
  - allows for forwarding data and metadata to a different external tier
  - Asynchronous
- Syncs data to remote cloud service using REST APIs
- Unidirectional
- Compatible with AWS (S3)
- Zone-level & Bucket-level sync possible
- Sync Info Provider (WIP)



# How to Configure

Similar to Multi-Site configuration but target zone tier type needs to be defined as cloud.

```
# radosgw-admin zone create --rgw-zonegroup={zone-group-name} --rgw-zone={zone-name} --endpoints={  
http://fqdn},{http://fqdn} --tier-type=cloud
```

The cloud tier configuration can be then done using the following command

```
# radosgw-admin zone modify --rgw-zonegroup={zone-group-name} --rgw-zone={zone-name} --tier-config={key}={val},{  
{key}={val}}
```

For more information, refer to

<https://docs.ceph.com/en/latest/radosgw/cloud-sync-module/>

For bucket-level granularity sync, refer to

<https://docs.ceph.com/en/latest/radosgw/multisite-sync-policy/>



# Trivial Configuration

```
{ "connection": {  
  "access_key": <access>,  
  "secret": <secret>,  
  "endpoint": <endpoint>,  
  "host_style": <path | virtual>,  
},  
"acls": [ { "type": <id | email | uri>,  
  "source_id": <source_id>,  
  "dest_id": <dest_id> } ... ],  
"target_path": <target_path>,  
}
```

- target path configurable
- possible to map permissions of specific source users to specific destination users.



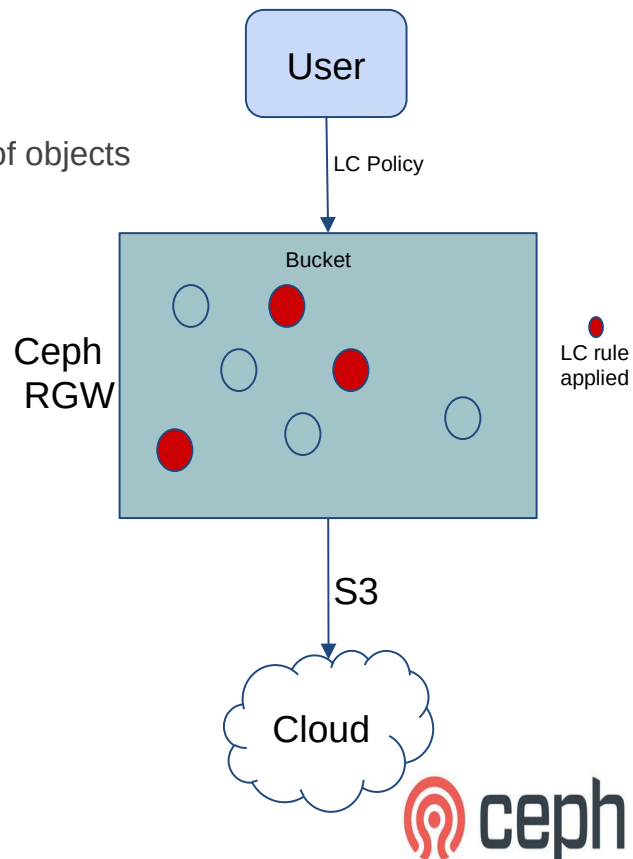


# Cloud Transition



# Cloud Transition

- Using S3 Lifecycle configuration and Storage-classes
  - set of rules that define actions that S3 server applies to a group of objects
    - Transition actions
    - Expiration actions
- Associates remote cloud endpoints to Lifecycle storage classes
- Enables data transition to cloud using lifecycle policies
- Unidirectional
  - Once transitioned, source object will be deleted.
  - Metadata can be retained.
- Compatible with AWS (S3)
- Available with Quincy Release (Ceph Upstream)



# How to configure

Similar to adding regular storage class but with tier-type defined as cloud-s3

```
# radosgw-admin zonegroup placement add --rgw-zonegroup={zone-group-name} --placement-id={placement-id} --storage-class={storage-class-name} --tier-type=cloud-s3
```

The cloud tier configuration can be then done using the following command

```
# radosgw-admin zonegroup placement modify --rgw-zonegroup={zone-group-name} --placement-id={placement-id} --storage-class={storage-class-name} --tier-config={key}={val}[,{key}={val}]
```

Note: Unlike regular storage classes, do not need a data pool.

- <https://docs.ceph.com/en/latest/radosgw/cloud-transition/>

## Configuring lifecycle policy:

The cloud storage class once configured can then be used like any other storage class in the bucket lifecycle rules. For example,

```
<Transition>  
  <StorageClass>CLOUDTIER</StorageClass>  
  ...  
</Transition>
```

Note: cloud storage class should be specified last among all the storage classes the object transitions to



# Trivial Configuration

```
{ "access_key": <access>,  
  "secret": <secret>,  
  "endpoint": <endpoint>,  
  "host_style": <path | virtual>,  
  "acls": [ { "type": <id | email | uri>,  
             "source_id": <source_id>,  
             "dest_id": <dest_id> } ... ],  
  "target_path": <target_path>,  
  "target_storage_class": <target-storage-class>,"  
  "retain_head_object": <true|false>  
}
```

- target path & storage class configurable
- possible to map permissions of specific source users to specific destination users.



# Current Capabilities & Limitations

- Uni-directional
- Only S3 compatible
- Once transitioned, the object cannot be read or transitioned back
- original object modification time and ETag get stored as metadata attributes on the destination objects

# Future Work



# Future work

- Support replication & transition to other cloud providers (like Azure).
- Sync Info Provider (Work In Progress)
  - <https://github.com/ceph/ceph/pull/38619>
- Federation between RGW and Cloud services.
  - Map Users, roles , bucket policies etc
- Send presigned redirect or read-through the objects transitioned to cloud
- Support s3:RestoreObject operation on cloud transitioned objects.



# Resources

<https://docs.ceph.com/en/latest/>

<https://docs.ceph.com/en/latest/radosgw/cloud-sync-module/>

<https://docs.ceph.com/en/latest/radosgw/cloud-transition/>

<https://github.com/ceph/ceph/pull/38619>

<https://docs.aws.amazon.com/AmazonS3/latest/userguide/object-lifecycle-mgmt.html>

<https://www.ibm.com/cloud/learn/hybrid-cloud>





# Thank You

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