

State of OpenShift Container Storage

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Container Storage

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OpenShift Storage Update

OPENSIFT STORAGE THEMES



Feature Expansion

Continue to work with upstream community to make sure that CSI is a complete spec, enabling all required features (like resize).



Flexibility

Enable storage to be used flexibly, focus on minimising any outages or lengthy operations



Enabling Choice

Focus on partner certification and enablement. Grow the storage options available on OpenShift by leveraging CSI and Operator Hub. Have OCS as the key OpenShift storage provider.



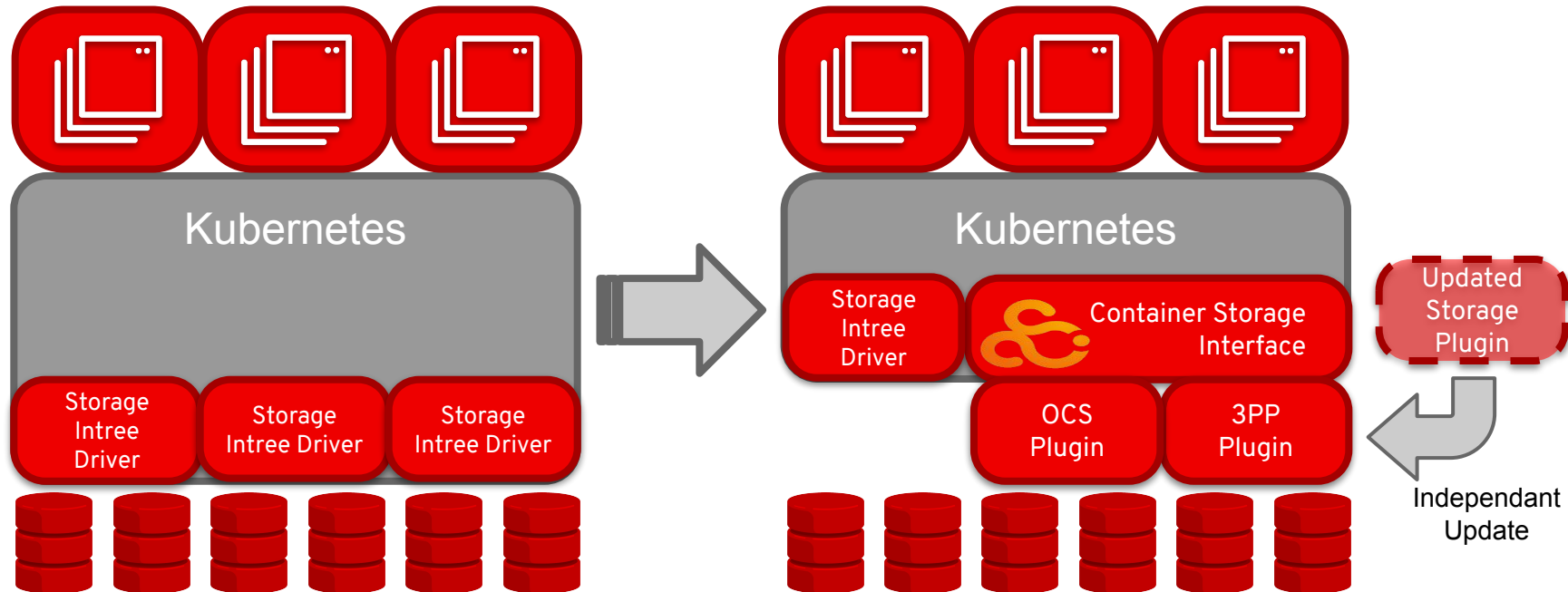
Observability

Bring in more metrics to allow not just monitoring but event correlation and preemptive actions

OPENSIFT CSI

4.1

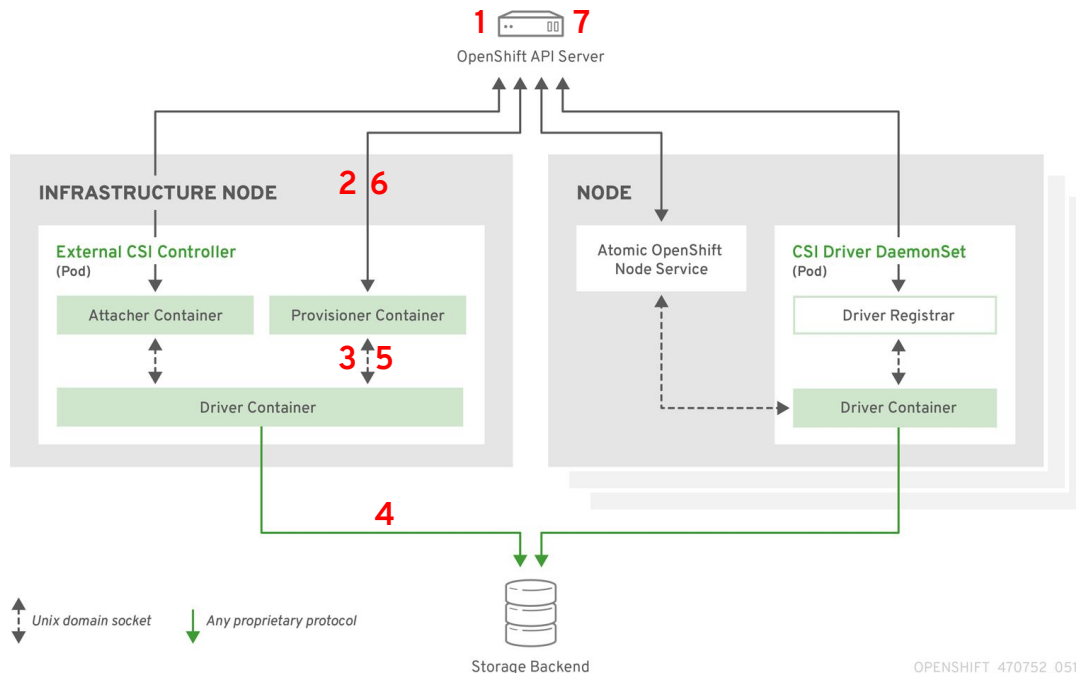
4.2



CSI: ENABLING OCS AND
PARTNERS

EXAMPLE: DYNAMIC PROVISIONING

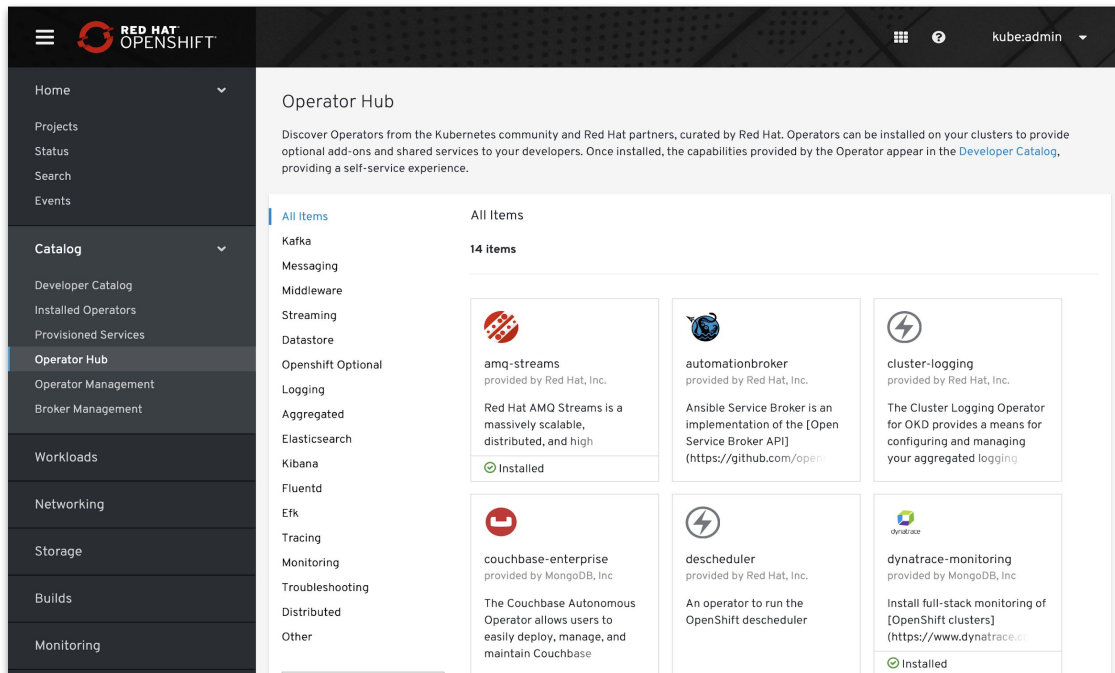
1. User creates a PVC (on API server).
2. The external provisioner gets an event that a new PVC was created.
3. The external provisioner initiates CreateVolume call to the CSI driver.
4. The CSI driver talks to storage backend and creates a volume.
5. The CSI driver returns a volume to the external provisioner.
6. The external provisioner creates PV on API server.
7. Kubernetes PV controller finishes the binding (PVC is Bound).



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OPERATORS IN OPENSSHIFT

Operator Hub - Allows administrators to selectively make operators available from curated sources to users in the cluster.



4.4 STORAGE DEVICES

Continued improvements

- CSI API work
 - Snapshot/Restore to Tech Preview
 - Clone to Tech Preview
 - Sidecar rebase
- Partner enablement
 - CSI Test Suite now included in 4.4
- Lots of extra focus on upstream work

OCP Supported

AWS EBS	Fibre Channel
Azure File & Disk	HostPath
GCE PD	Local Volume
VMware vSphere Disk	Raw Block
NFS	iSCSI

Supported via OCS

File , Block, Raw Block, Object

Supported via OSP

Cinder

OPENSIFT STORAGE ROADMAP

Near Term (4.4)

- CSI
 - Snapshot Tech Preview
 - Clone Tech Preview
 - Certification suite

Medium Term (4.5)

- CSI API
 - Resize (GA)
 - Cloning (GA)
 - Raw Block (GA)
- CSI Drivers
 - AWS EBS (Tech Preview)
 - Ephemeral aka Inline Volumes (Tech Preview)
- Enhancements
 - Local Storage discovery
 - Recursive permissions

Long Term (4.6+)

- CSI
 - Migration
 - Snapshot/Restore to GA
 - Cloud provider CSI drivers
 - Ephemeral storage GA
- 3rd Party vendor storage
- More customer RFEs
- Storage metrics



Dynamic, shared, and highly available storage for OpenShift applications

Eran Tamir
Product Management

What is OpenShift Container Storage ?

Highly scalable, production-grade persistent storage

- For **stateful applications** running in Red Hat® OpenShift
- Optimized for Red Hat **OpenShift Infrastructure services**
- Developed, released and deployed in synch with Red Hat OpenShift
- Supported via a single contract with Red Hat OpenShift
- Complete persistent storage fabric across hybrid cloud for OCP

Red Hat OpenShift Container Storage



Options

- Runs in all possible infrastructure environments
- No vendor lock-in: Freedom of choice



Efficiency

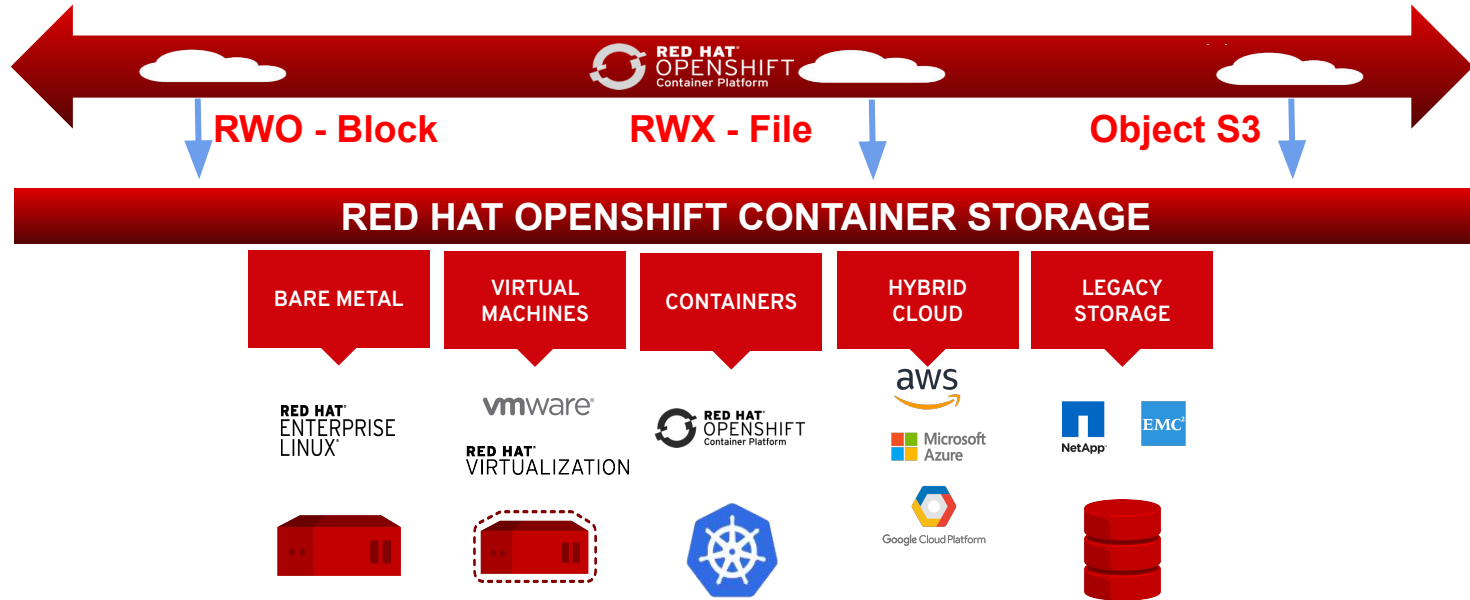
- Use of automation to improve efficiency
- Increase utilization of existing storage
- Meets container application's storage needs and protocols



Scalability

- Start small and scale to future needs
- Always balanced and optimized
- Handles petabytes of data

Complete Storage for Container Platform



Provides Storage for All Apps and infrastructure Services
in their native interfaces

Operator Driven Install from OLM

The screenshot displays the Red Hat OpenShift Container Platform interface. The top navigation bar shows the Red Hat logo and 'OpenShift Container Platform'. A blue banner indicates the user is logged in as a temporary administrative user. The left sidebar contains a navigation menu with categories like Administrator, Home, Operators, OperatorHub, Installed Operators, Workloads, Networking, Storage, Builds, Monitoring, Compute, and Administration. The main content area is titled 'OperatorHub' and provides a description of operators. Below this, a 'Storage' section is active, showing a list of operators categorized by provider type (Community, Custom) and installation state (Installed, Not Installed). The operators listed include AWS S3 Operator, Local Storage, OpenEBS, Openshift Container Storage Operator, Portworx Enterprise, Robin Storage, and StorageOS.

OperatorHub

Discover Operators from the Kubernetes community and Red Hat partners, curated by Red Hat. Operators can be installed on your clusters to provide optional add-ons and shared services to your developers. Once installed, the capabilities provided by the Operator appear in the [Developer Catalog](#), providing a self-service experience.

Storage

Filter by keyword...

7 items

Provider Type	Operator Name	Provider	Installation State
Community	AWS S3 Operator	provided by Red Hat	Not Installed
Custom	Local Storage	provided by Red Hat	Installed
Community	OpenEBS	provided by OpenEBS project	Not Installed
Custom	Openshift Container Storage Operator	provided by Red Hat	Installed
Community	Portworx Enterprise	provided by Portworx	Not Installed
Community	Robin Storage	provided by Robin.io	Not Installed
Community	StorageOS	provided by StorageOS, Inc	Not Installed

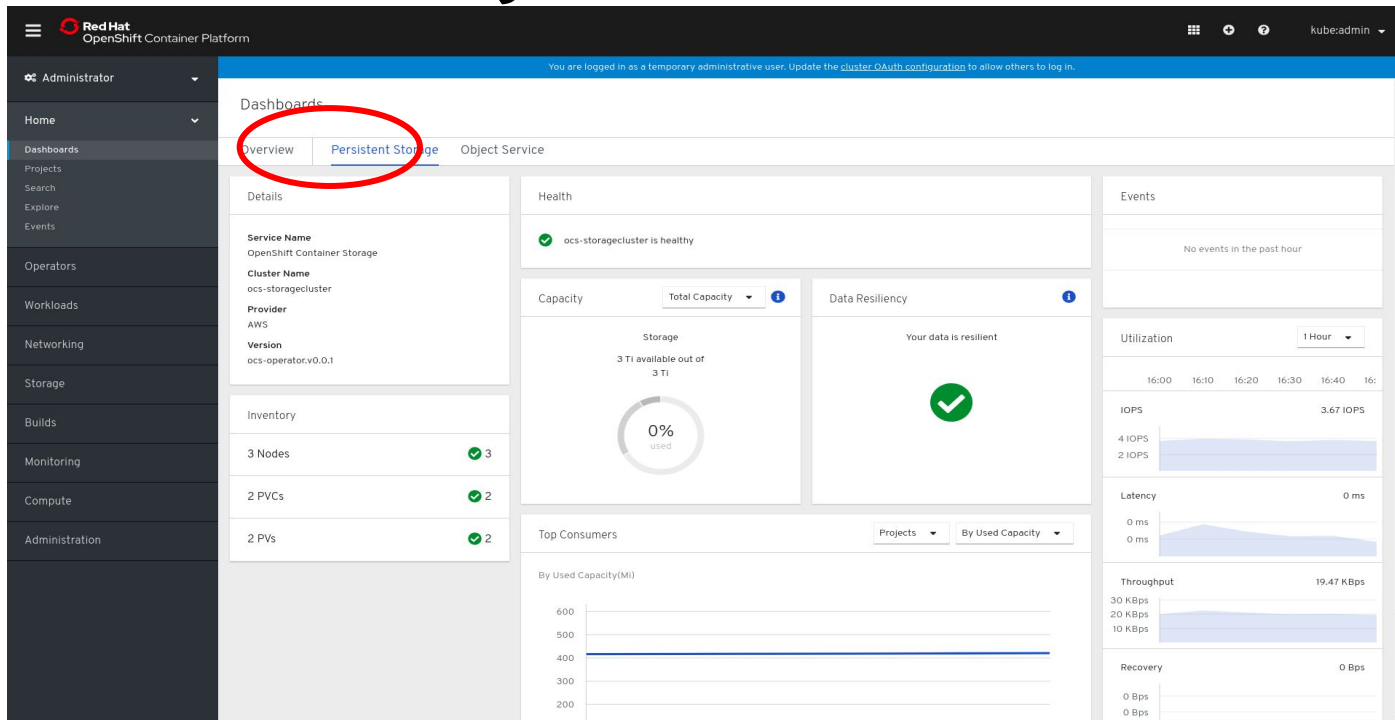
INSTALL STATE

- Installed (2)
- Not Installed (5)

PROVIDER TYPE

- Red Hat (0)
- Certified (3)
- Community (2)
- Custom (2)

Integrated Dashboard



Day 2 Operations

The screenshot shows the Red Hat OpenShift Container Platform interface. A modal dialog titled "Add Capacity" is open, prompting the user to increase the capacity of the 'ocs-storagecluster'. The dialog contains the following fields:

- Requested Capacity:** A text input field containing the value "1".
- Provisioned Capacity:** A dropdown menu currently showing "1Ti".
- Storage Class:** A dropdown menu showing "gp2".

A red circle highlights the "Requested Capacity" and "Provisioned Capacity" fields. At the bottom of the dialog are "Cancel" and "Add" buttons.

In the background, the "OCS Cluster Services" section is visible, featuring a "Create OCS Cluster Service" button and a table with the following data:

Name	Labels	Kind	Status	Version
example-storagecluster	No labels	StorageCluster	Unknown	Unknown

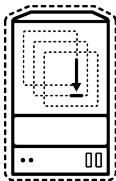
Hybrid and Data Services

Multi Cloud Object Gateway



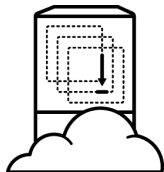
Start lean

A single lightweight pod for basic development and tests



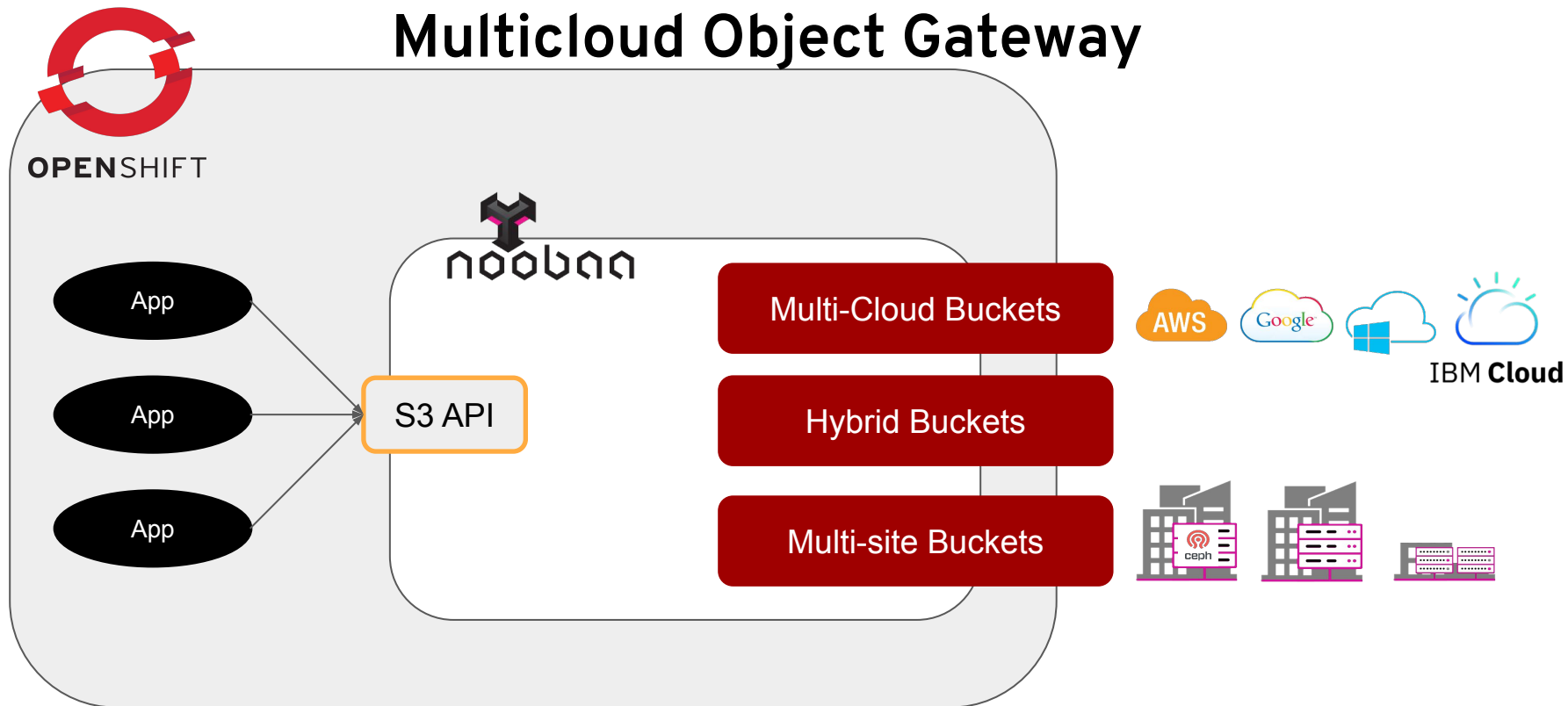
Scale locally

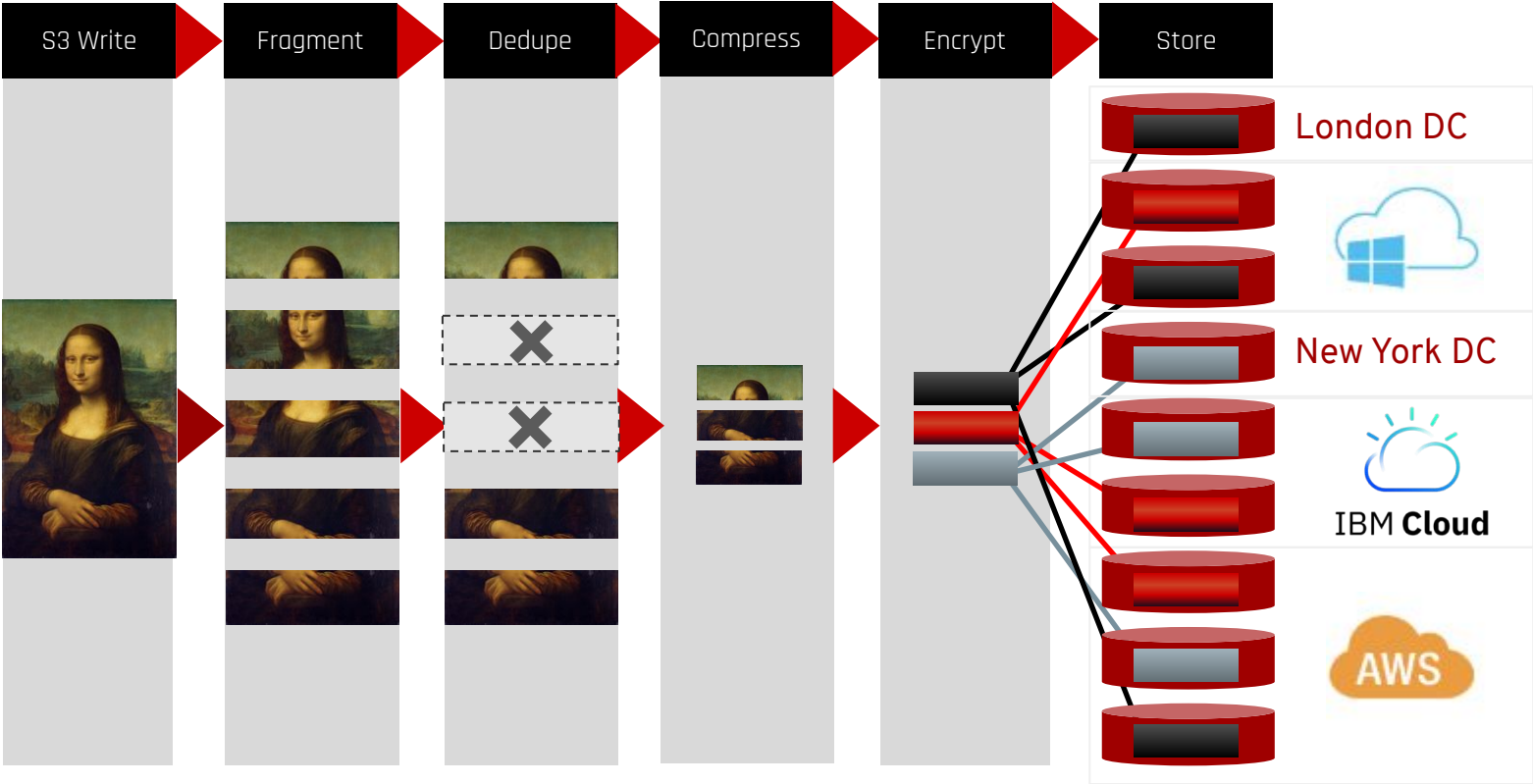
Scale with local volumes or Red Hat Ceph Storage



Workload portability

Easily mirror data to other cluster or native cloud storage





Workloads & Technology

Workloads per Service

Persistent Volume

Block

- Primary for DB and Transactional workloads
- Low latency
- Messaging

Provided by Rook-Ceph

Shared File System

- POSIX-compliant shared file system
- Interface for legacy workloads
- CI/CD Pipelines
- AI/ML Data Aggregation

Provided by Rook-Ceph

Object Service

- Media, AI/ML training data, Archiving, Backup, Health Records
- Great Bandwidth performance
- Object API (S3/Blob)

Provided by Multi-Cloud Object Gateway

OCP 4 with OCS 4 - Technology Stack

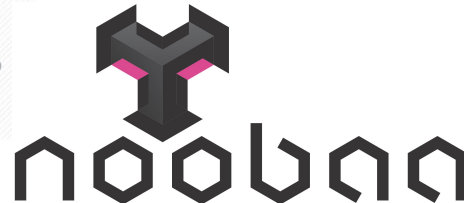


**Easy & Automated
Management with
Operators**



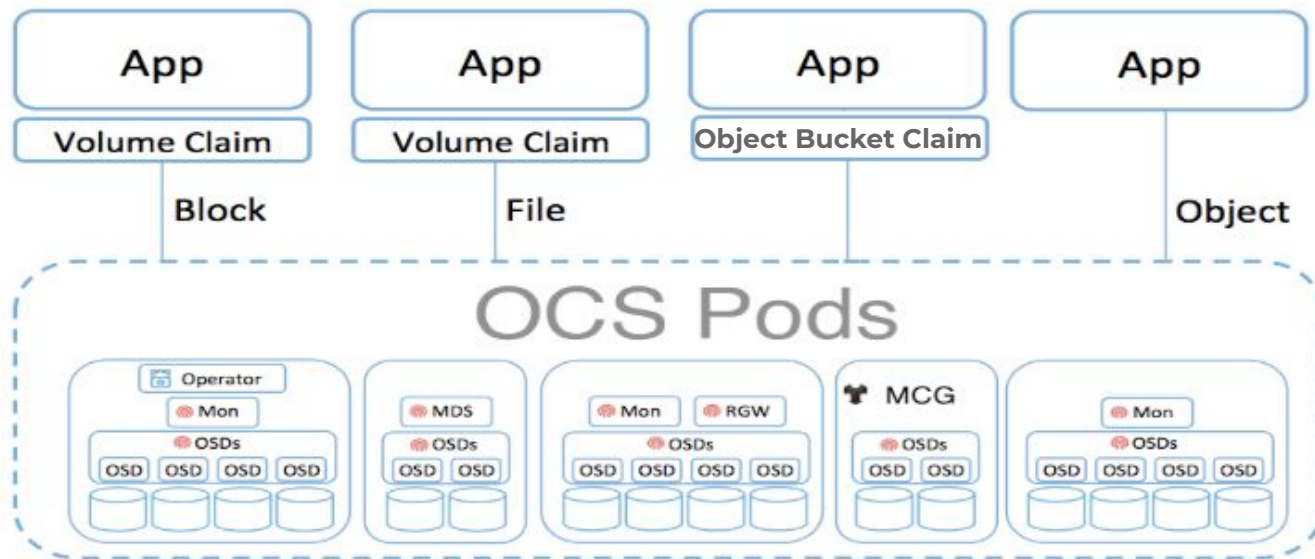
ceph

**Highly Resilient &
Scalable Storage
System**



**Multi-Cloud & Hybrid
Object Storage**

OCS Operator based on Operator SDK with Operator Lifecycle Manager (OLM)

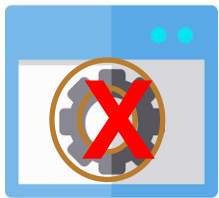


OBJECT BUCKET CLAIM



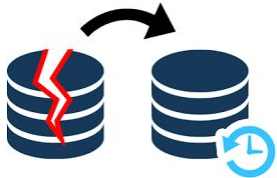
Data Protection

Backup & Disaster Recovery (DR)



Backup Solution

- ▶ Protection against Logical failures
 - User errors – accidental deletion, Bad Actors, Application software bugs, Malicious software - virus,
- ▶ Restore to the previous point-in-time copy of the data and/or application state
- ▶ Based on Snapshots – local and/or remote



WAN DR Solution

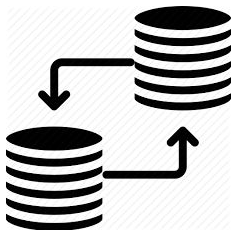
- ▶ Protection against Data Center disasters with large blast radius
 - Data Center failures due to power grid or HVAC issues, Geographic scale natural disasters – flooding, earthquakes
- ▶ Automated Failover to remote Standby or Hot site with Async Replication



Metro HA-DR Solution

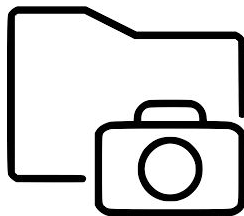
- ▶ Protection against HW failures with small blast radius
 - Hardware component, systems or rack level failures
- ▶ Automatic Failover across Availability Zones with Sync Mirroring

Building blocks for OCP-OCS Data Protection



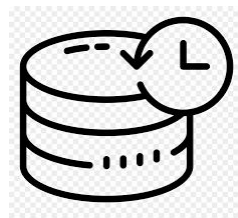
Data Mirroring

Synchronous data copy provides resiliency against HW failures without data loss



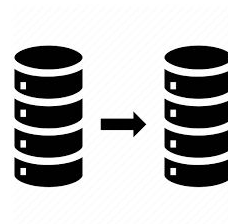
Snapshots

Point-in-Time consistent data copies provides protection against logical failures



Backup

Building upon snapshots, backups enable restoring applications to pre-failure state



Data Replication

Data asynchronously copied to remote sites enable application recovery for data center failures

What next?

OpenShift Container Storage 4 Backlog

Platforms [Alongside effort]

- OpenStack
- Azure
- Google
- IBM Cloud
- RHV
- Alibaba

Multicloud Object Gateway

- Multi-Cluster HA
- Cache mode for edge
- MCM integration for multi-cluster deployment and dashboard
- Namespace policies

Data Protection

- **Backup**
 - Snapshots/Clone/Restore
 - Backup API for 3rd party partners
- **Disaster Recovery** - Manual failover
 - Active/Passive solution with async replication
- **HA Disaster Recovery** - Automatic failover in low latency
 - Stretch cluster with arbiter
 - Multi Cluster - sync replication or volumes

Security

- Encryption at rest and in transit
- KMS integration

Scalability

- Independent mode - Shared, Scalable Storage
- Support for 10K PVs in 20 nodes

<https://www.openshift.com/storage>

Thank you

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