Software Defined Storage Overview

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Cloud Specialist Solution Architect
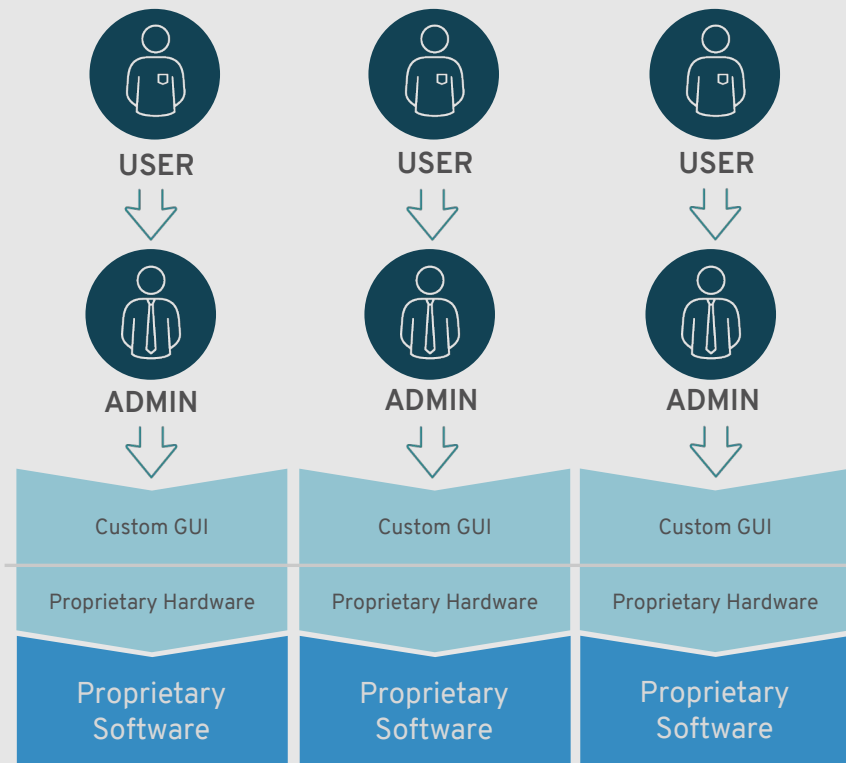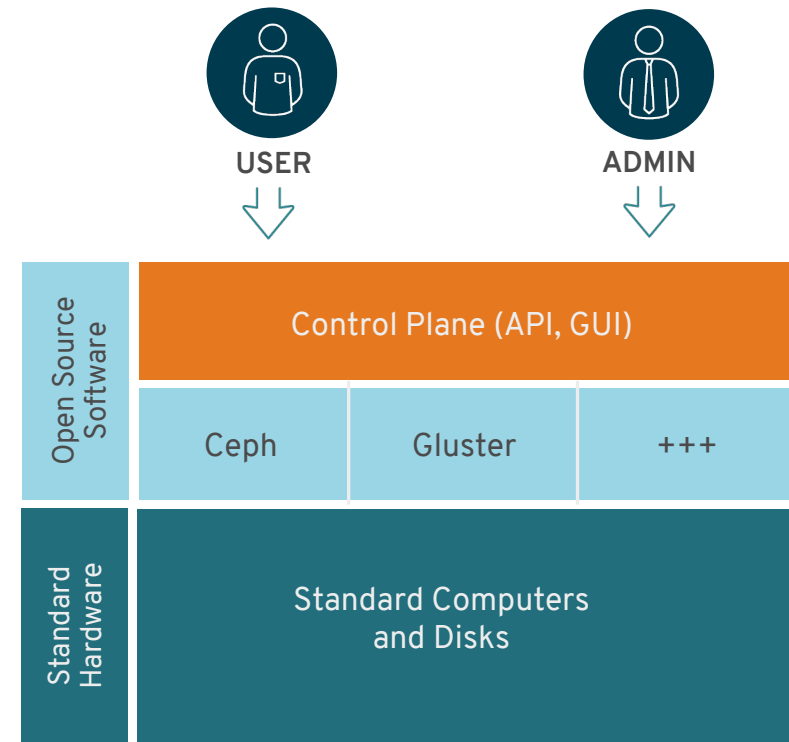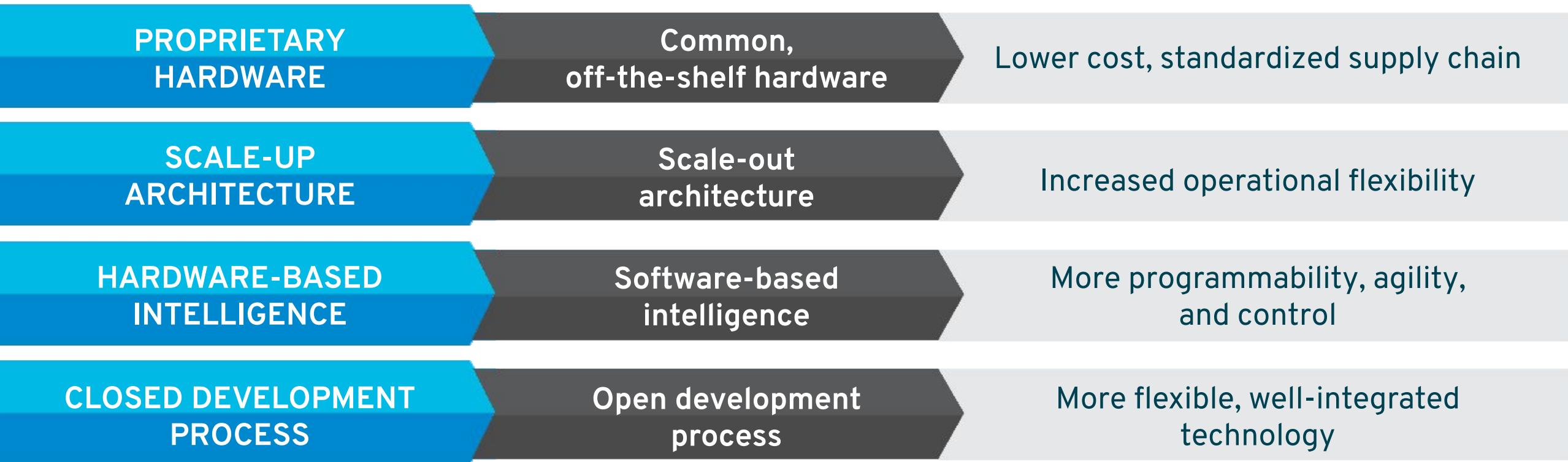
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Why Red Hat Storage?

STORAGE IS EVOLVING

TRADITIONAL STORAGE
Complex proprietary silos

OPEN, SOFTWARE-DEFINED STORAGE
Standardized, unified, open platforms

USER   USER   USER

ADMIN   ADMIN   ADMIN

| Custom GUI | Custom GUI | Custom GUI |

| Proprietary Hardware | Proprietary Hardware | Proprietary Hardware |

| Proprietary Software | Proprietary Software | Proprietary Software |

USER   ADMIN

Open Source Software

Control Plane (API, GUI)

| Ceph | Gluster | +++ |

Standard Hardware

Standard Computers and Disks

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WHY THIS MATTERS

PROPRIETARY HARDWARE	**Common, off-the-shelf hardware**	Lower cost, standardized supply chain
SCALE-UP ARCHITECTURE	**Scale-out architecture**	Increased operational flexibility
HARDWARE-BASED INTELLIGENCE	**Software-based intelligence**	More programmability, agility, and control
CLOSED DEVELOPMENT PROCESS	**Open development process**	More flexible, well-integrated technology

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A RISING TIDE

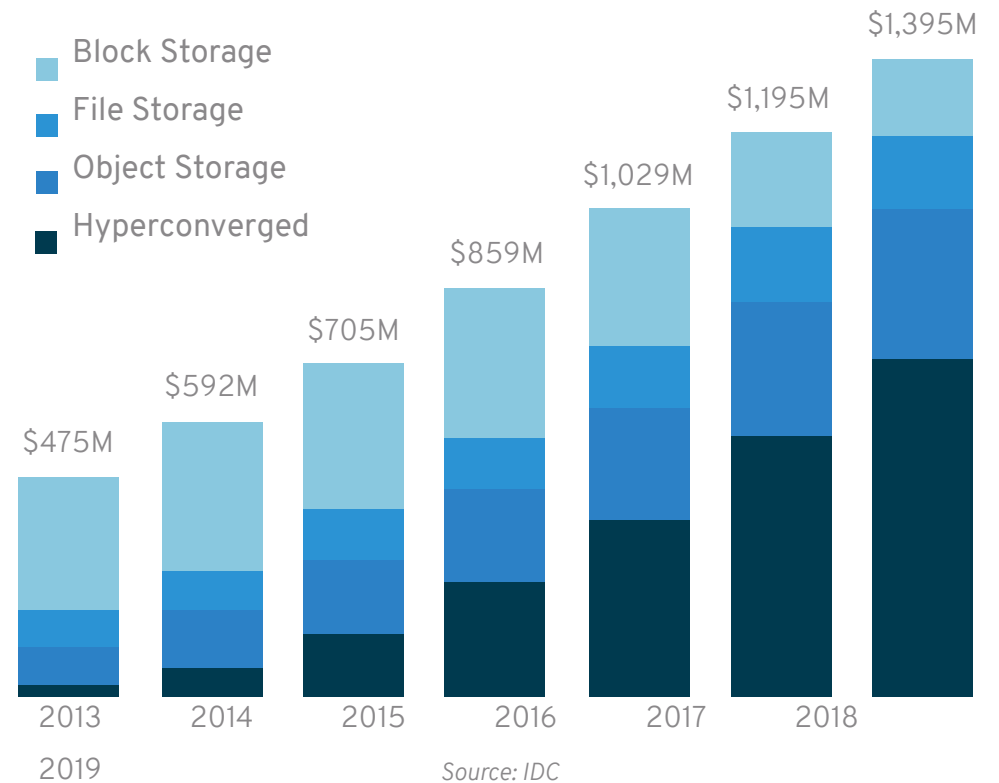Software-Defined Storage is leading a shift in the global storage industry, with far-reaching effects.

"By 2020, between 70%-80% of unstructured data will be held on lower-cost storage managed by SDS."

Innovation Insight: Separating Hype From Hope for Software-Defined Storage

"By 2019, 70% of existing storage array products will also be available as software-only versions."

Innovation Insight: Separating Hype From Hope for Software-Defined Storage

SDS-P MARKET SIZE BY SEGMENT

- Block Storage
- File Storage
- Object Storage
- Hyperconverged

$475M
$592M
$705M
$859M
$1,029M
$1,195M
$1,395M

2013
2014
2015
2016
2017
2018
2019

Source: IDC

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THE RED HAT STORAGE MISSION

To offer a unified, open software-defined storage portfolio that delivers a range of data services for next generation workloads, thereby accelerating the transition to modern IT infrastructures.

Red Hat Ceph Storage

BUSINESS BENEFITS

OPEN SOURCE

No proprietary lock-in, with a large commercial ecosystem and broad community

PEACE OF MIND

Over a decade of active development, proven in production and backed by Red Hat
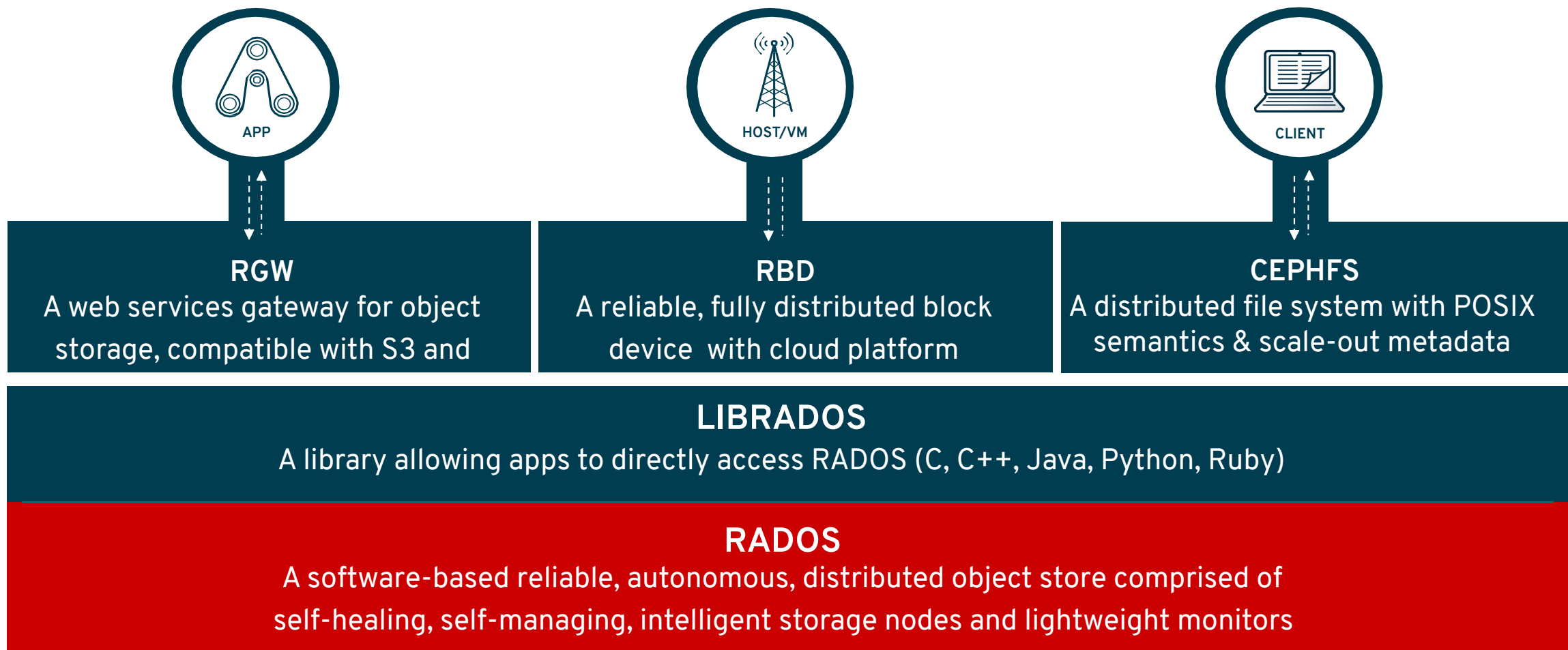
LOWER COST

More economical than traditional NAS/SAN, particularly at petabyte scale

RED HAT CEPH STORAGE

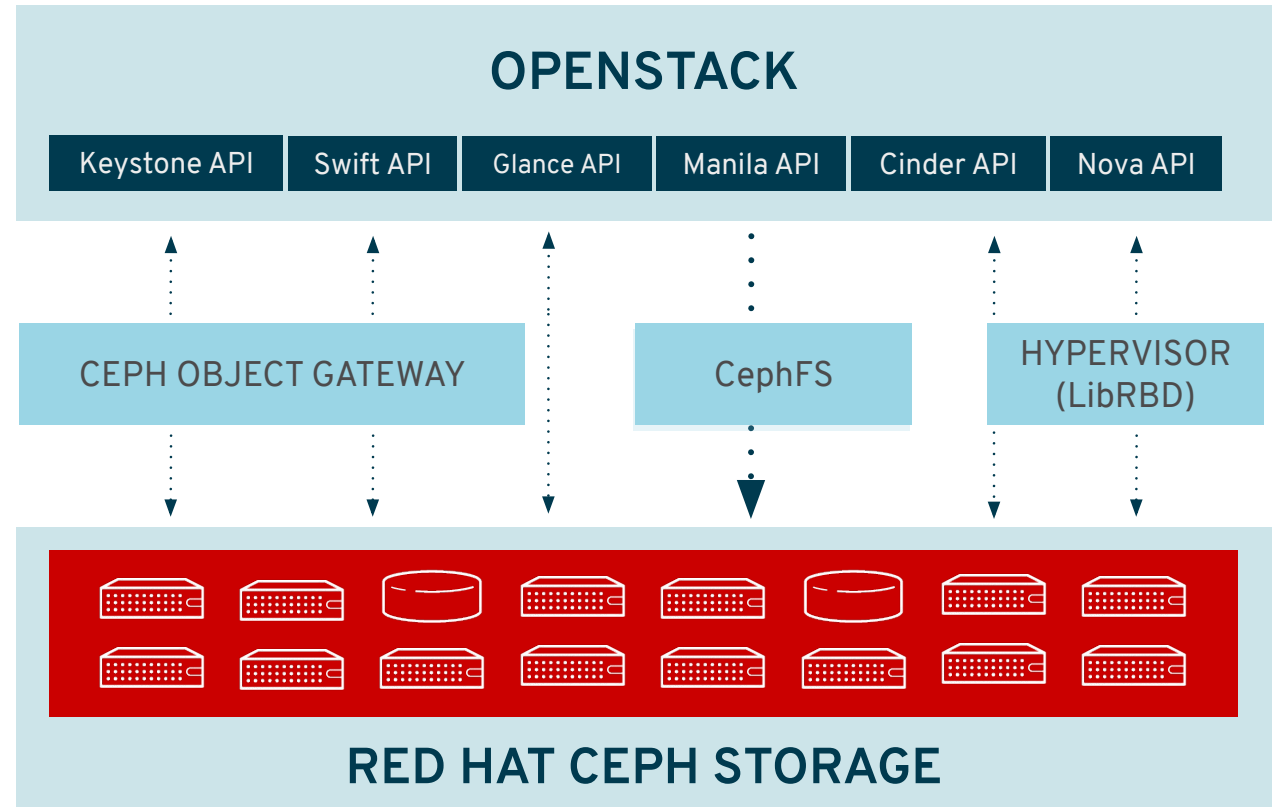Distributed, enterprise-grade object storage, proven at web scale

- Open, massively-scalable, software-defined

- Flexible, scale-out architecture on clustered standard hardware

- Single, efficient, unified storage platform (object, block, file)

- User-driven storage lifecycle management with 100% API coverage

  - S3 compatible object API

- Designed for modern workloads like cloud infrastructure and data lakes

ARCHITECTURAL COMPONENTS

APP

HOST/VM

CLIENT

RGW
A web services gateway for object storage, compatible with S3 and

RBD
A reliable, fully distributed block device with cloud platform

CEPHFS
A distributed file system with POSIX semantics & scale-out metadata

LIBRADOS
A library allowing apps to directly access RADOS (C, C++, Java, Python, Ruby)

RADOS
A software-based reliable, autonomous, distributed object store comprised of self-healing, self-managing, intelligent storage nodes and lightweight monitors

COMPLETE OPENSTACK STORAGE

- Deeply integrated with modular architecture and components for ephemeral & persistent storage

  ➤ Nova, Cinder, Manila, Glance, Keystone, Ceilometer, Swift, Gnocchi

- 64 TB bundled 'once' in Red Hat OpenStack Platform for evaluation

OPENSTACK

Keystone API	Swift API	Glance API	Manila API	Cinder API	Nova API

CEPH OBJECT GATEWAY

CephFS

HYPERVISOR (LibRBD)

RED HAT CEPH STORAGE

ADVANTAGES FOR OPENSTACK USERS

- Instantaneous booting of 1 or 100s of VMs

- Instant backups via seamless data migration between Glance, Cinder, Nova

- Tiered I/O performance within single cluster

- Multi-site replication for disaster recovery or archiving

VM

HYPERVISOR

RED HAT CEPH STORAGE
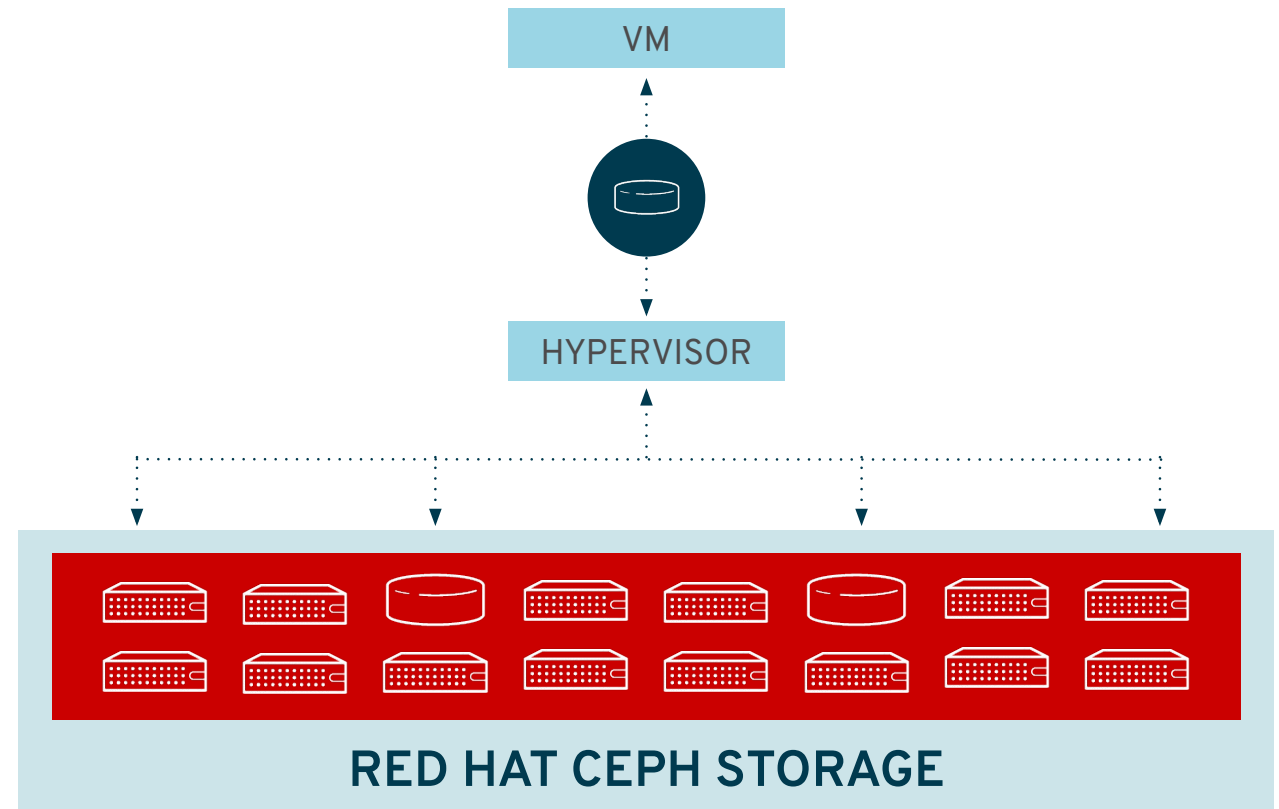
TARGET USE CASES

- **Private Cloud** - enterprise deployments growing for test & dev and production application deployments. FSI, retail and technology sectors.

- **Archive & Backup:** object storage as a replacement for tape and expensive dedicated appliances. Hybrid cloud compatibility critical.

- **NFVi** (new) - OpenStack with Ceph dominant reference platform for next-generation telco networks. Global demand for Ceph now standalone and hyperconverged.

- **Enterprise Virtualization** (new): legacy protocol support for legacy VM storage to be managed on same platform as modern, private cloud storage.

- **Big Data** (new) - object storage providing common, data lake for multiple analytics applications for greater efficiencies and better business insights

Red Hat Gluster Storage

Red Hat

RED HAT GLUSTER STORAGE ADVANTAGES

OPEN
Open, software-defined distributed file and object storage system

- Based on GlusterFS open source community project
- Uses proven local file system (XFS)
- Data is stored in native format

SCALABLE
No Metadata Server

- Uses an elastic hashing algorithm for data placement
- Uses local filesystem's xattrs to store metadata
- Nothing shared scale-out architecture

ACCESSIBLE
Multi-Protocol the Same Data

- Global namespace
- NFS, SMB, object, Gluster native protocol
- Posix compliant

MODULAR
No Kernel Dependencies

- GlusterFS is based on filesystem in userspace (FUSE)
- Modular stackable arch allows easy addition of features
  ...without being tied to any kernel version

ALWAYS-ON
High-Availability across data, systems and applications

- Synchronous replication with self-healing for server failure
- Asynchronous geo-replication for site failure

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GLUSTER ARCHITECTURE

Distributed scale out storage using industry standard hardware

NFS   **CIFS**   **FUSE**

SERVERS WITH LOCAL DISKS
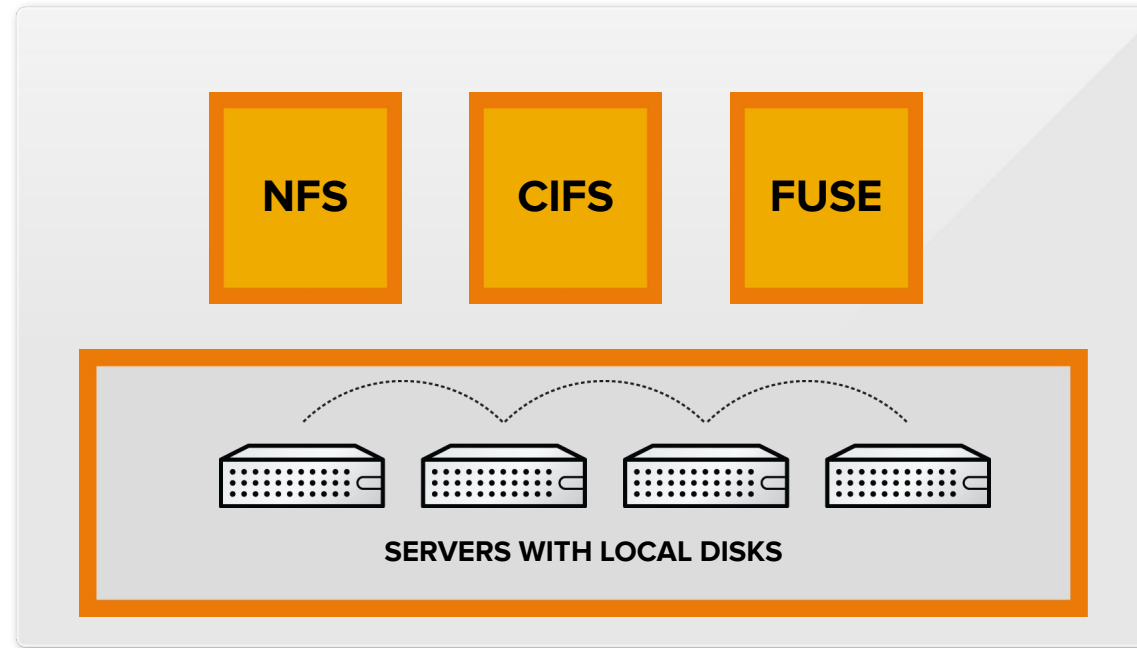
**Aggregates systems to one cohesive unit
and presents using common protocols**

WHAT IS A SYSTEM?

Can be physical, virtual or cloud

PHYSICAL

SERVER
(CPU/MEM)

1 TB   1 TB

VIRTUAL

CLOUD

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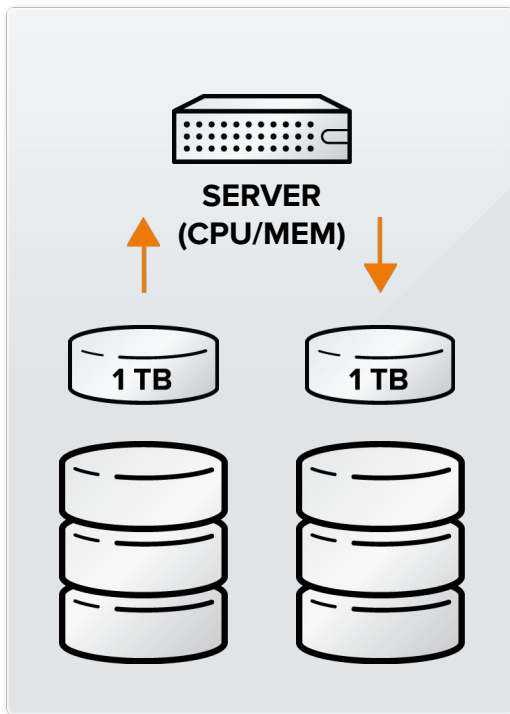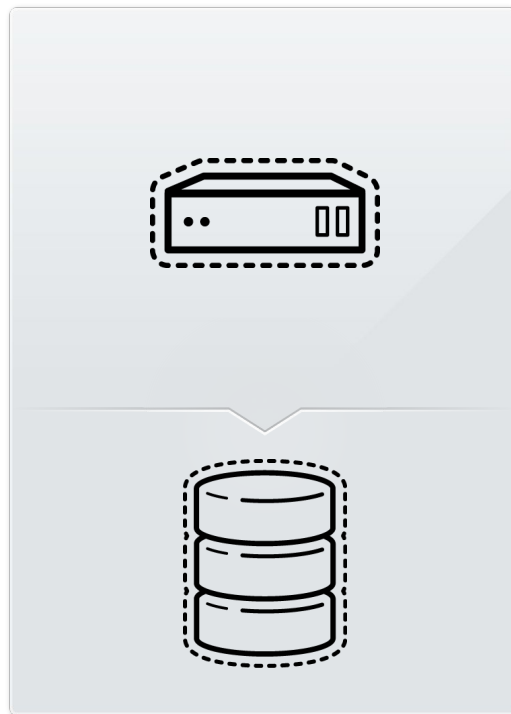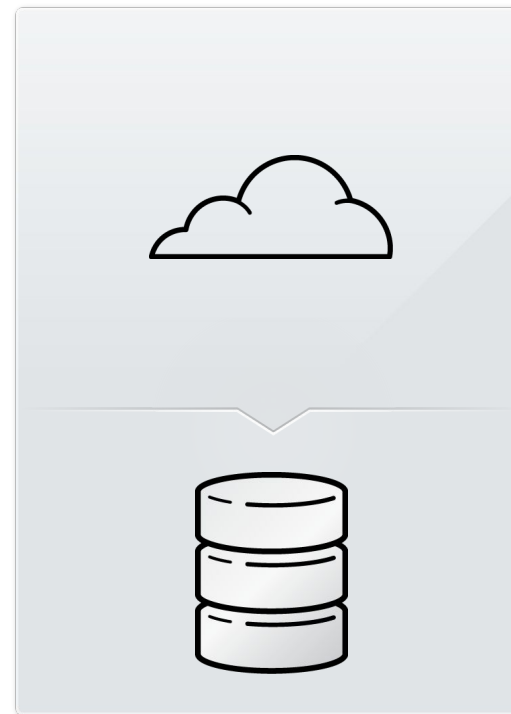
VOLUMES

Bricks taken from multiple hosts become one addressable unit

- High availability as needed

- Load balanced data

- Managed by Gluster

CLIENTS

SERVER   SERVER

BRICK   BRICK   BRICK   BRICK
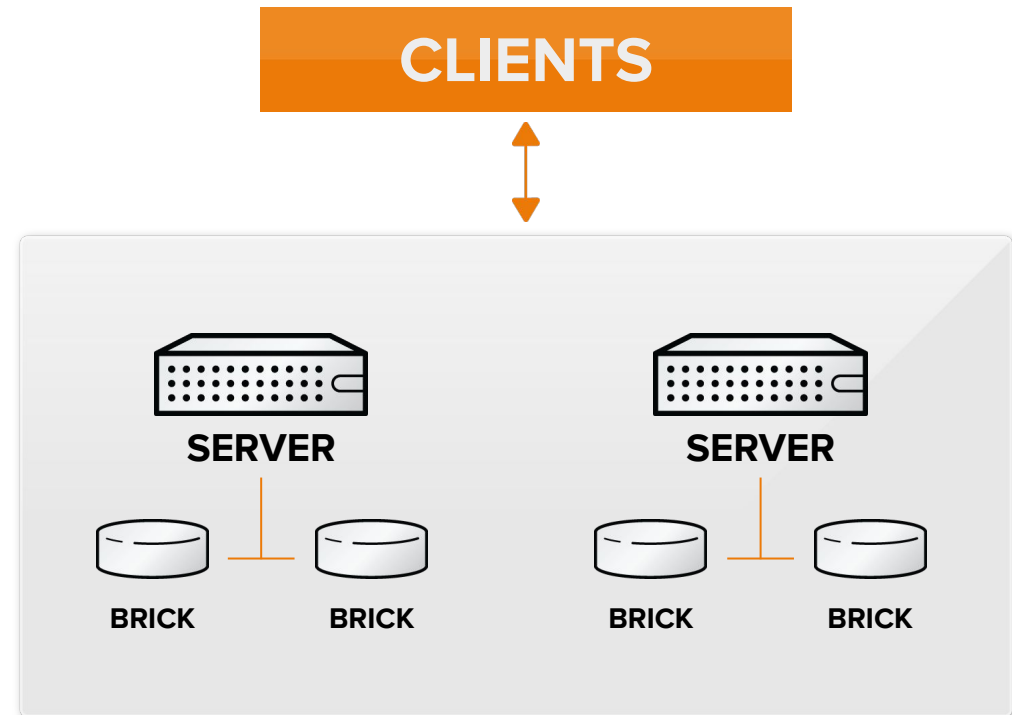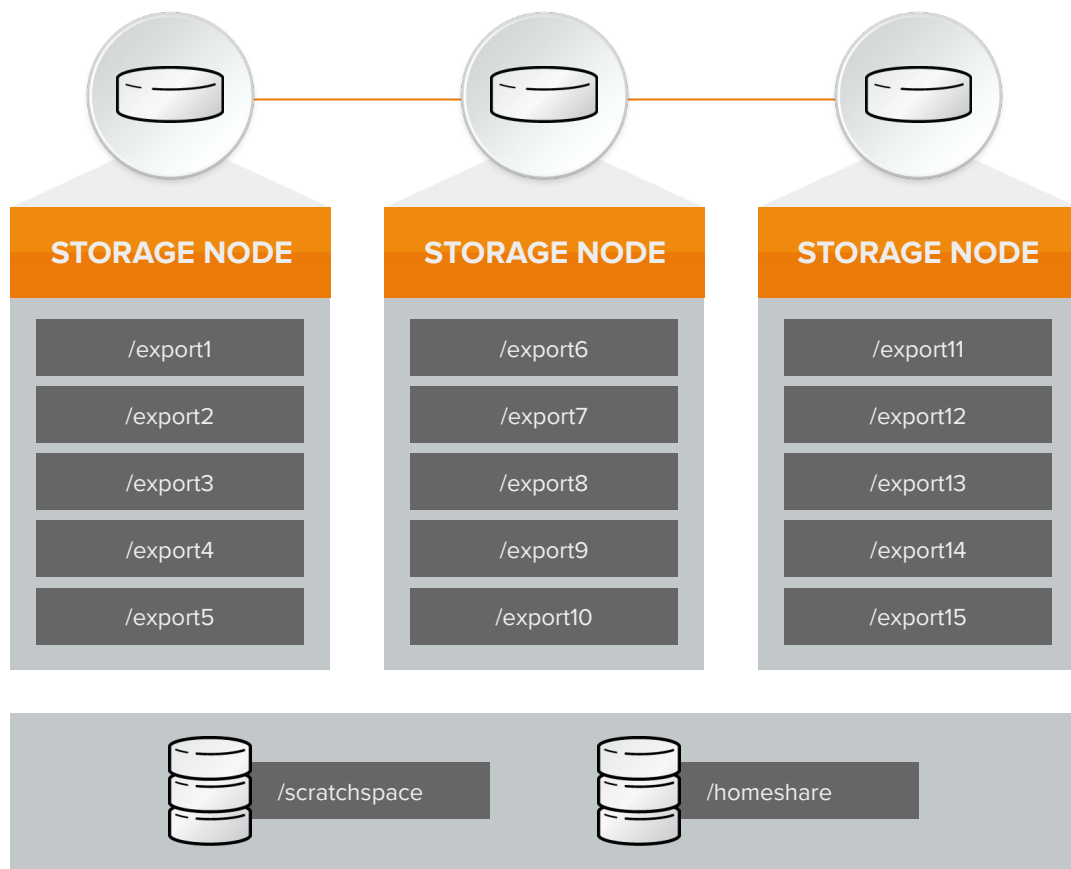
VOLUMES

A Volume is some number of bricks >1, exported by RHGS

- Volumes have administrators assigned names
- A brick can be a member of one volume
- Data in different volumes physically exists on different bricks
- Volumes can be mounted on clients

NFS

Accessibility from UNIX and Linux systems

- **STANDARD NFS** connects to NFS Ganesha process on storage node

- **MOUNT GlusterFS VOLUME** from any storage node

- **NFS GANESHA** includes network lock manager to synchronize locks

- **LOAD BALANCING** must be managed externally

- **STANDARD AUTOMOUNTER** is supported.

- **SUPPORTED FEATURES:** ACLs, NFSv4, Kerberos

Better performance reading many small files from a single client

SAMBA/CIFS

Accessibility from Windows systems

- **STORAGE NODE** uses Samba with winbind to connect with AD

- **SMB CLIENTS** can connect to any storage node running Samba

- **SMB VERSIONS** 2.0 & 3.0 supported

- **LOAD BALANCING** must be managed externally

- **CTDB** is required for Samba clustering

Samba uses RHGS gfapi library to communicate directly with GlusterFS server process without going through FUSE

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OBJECT ACCESS

of GlusterFS Volumes

- **BUILT UPON** OpenStack's Swift object storage system

- **BACK-END FILE SYSTEM** for OpenStack Swift Accounts as GlusterFS volumes

- **STORE AND RETRIEVE** files using the REST interface

- **SUPPORT INTEGRATION** with SWAuth and Keystone authentication service

Implements objects as files and directories
under the container ("Swift on File")

GEO-REPLICATION

Multi-site content distribution

- Asynchronous across LAN, WAN, or Internet

- Master-slave model, cascading possible

- Continuous and incremental

- Multiple configurations

  - One to one

  - One to many

  - Cascading
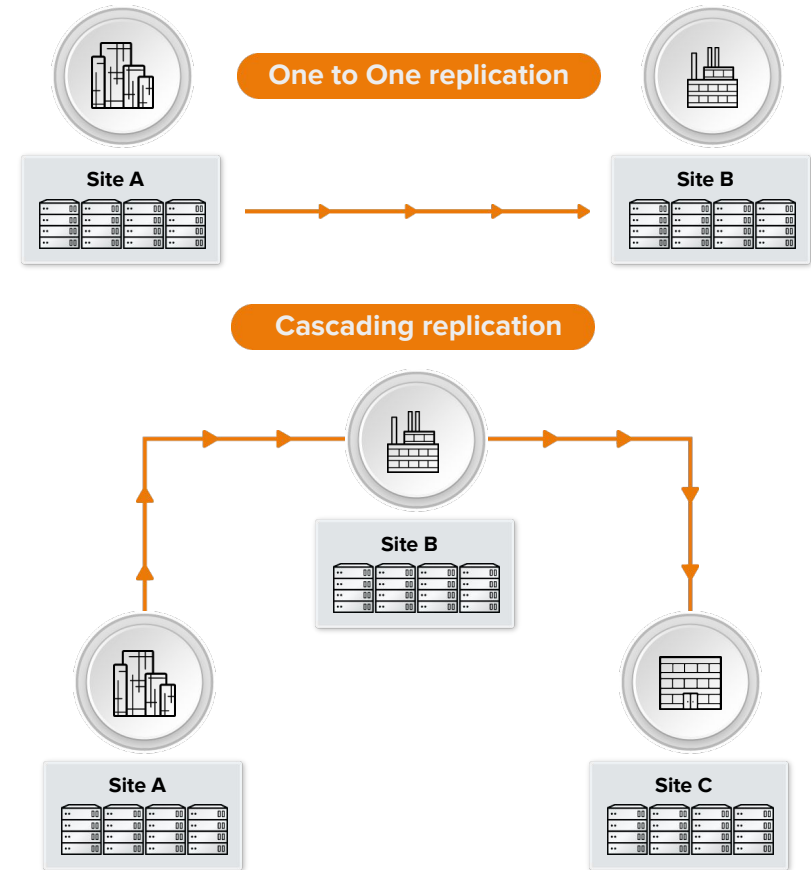
One to One replication

Site A

Site B

Cascading replication

Site B

Site A

Site C

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Red Hat Openshift Container Storage

WHAT STORAGE OPTIONS DO YOU HAVE FOR YOUR CONTAINERS?

OUTDATED STORAGE ARRAYS AND APPLIANCES

- Scalability and high availability fall short of customer needs
- Vendor lock in and high TCO
- Monolithic appliance model
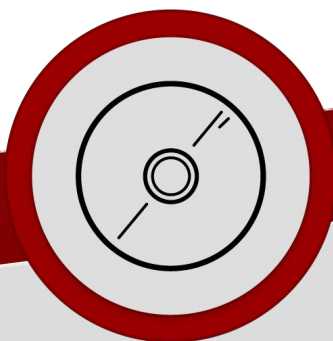
SILOED OR POINT PLAY STORAGE SOLUTIONS

- No hybrid cloud support
- No unified control plane (K8s)
- Lack of automated or dynamic provisioning of storage

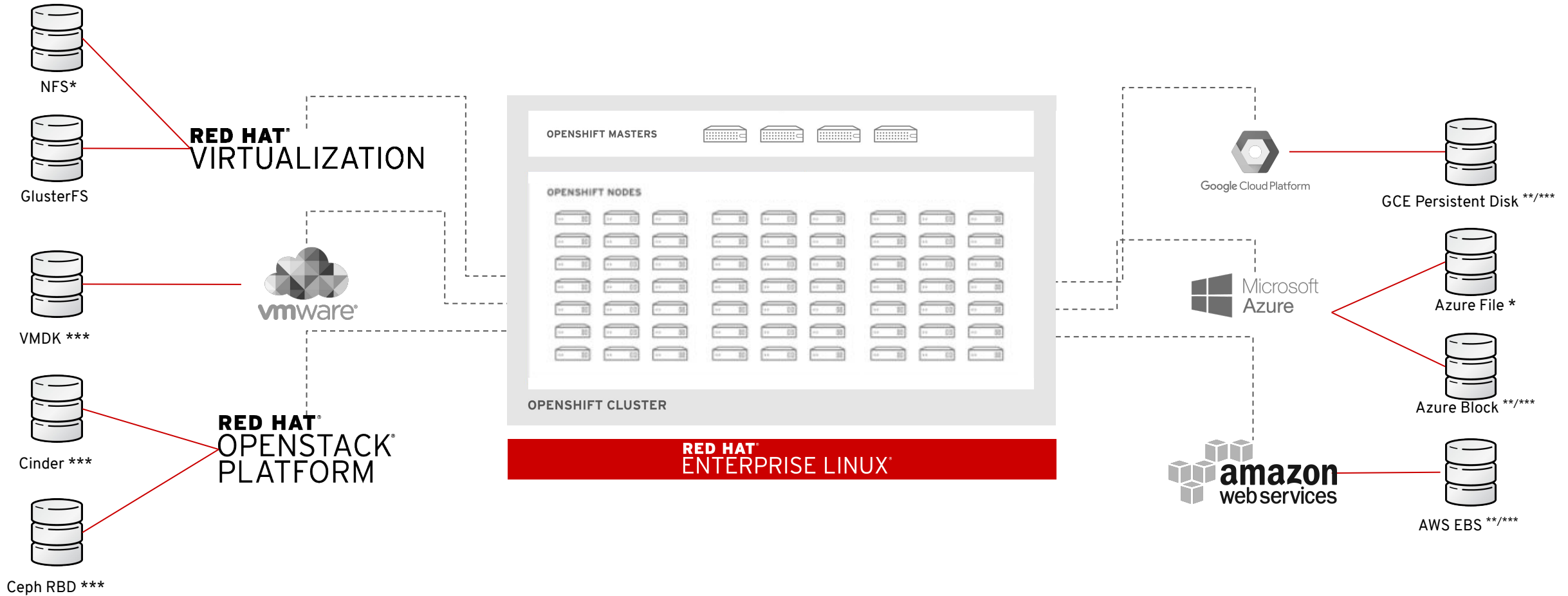## PORTABLE STORAGE ACROSS ON-PREM / PUBLIC CLOUDS

RED HAT®
OPENSHIFT
Container Storage

- Runs to all 3 public clouds
- Single Vendor Support model
- Seamless user experience for developers and DevOps

WHAT IS OPENSHIFT CONTAINER STORAGE?

- Highly scalable, enterprise-grade storage
- 2 Deployment options: independent and converge mode
- Native integration with OpenShift
- Unified Orchestration using Kubernetes for applications and storage
- Greater control & ease of use for developers
- Developed, maintained, and deployed in synch with Red Hat OpenShift releases
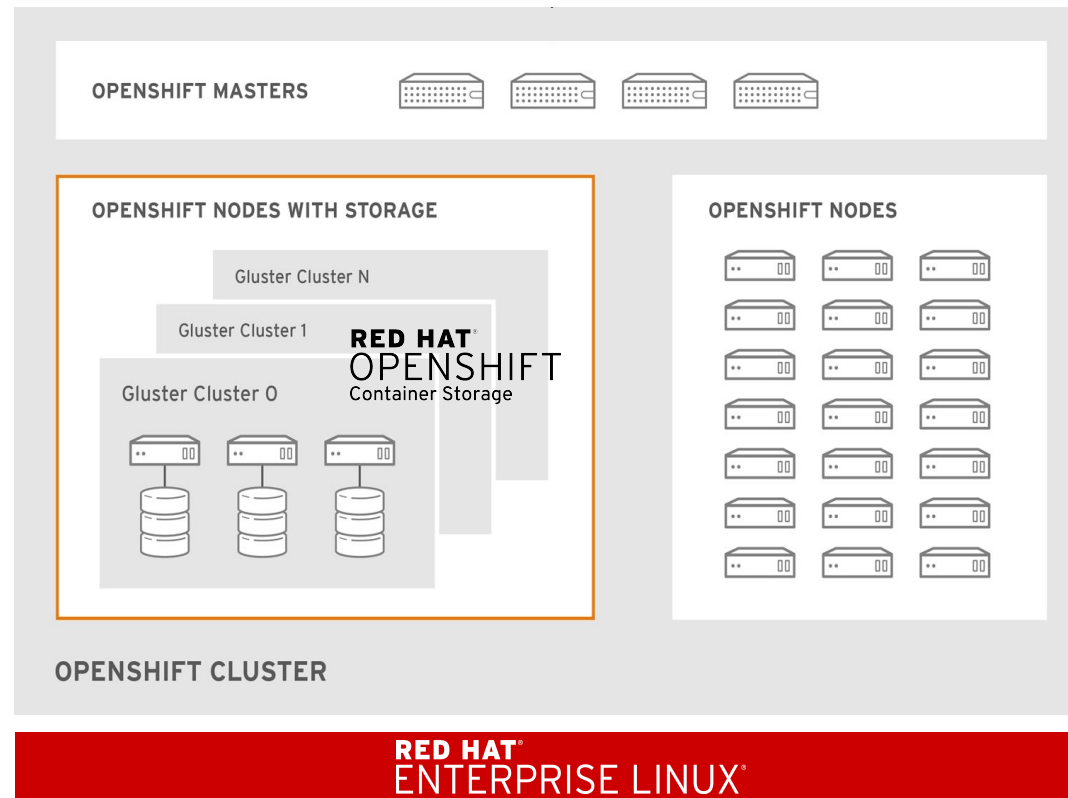- Single vendor Support
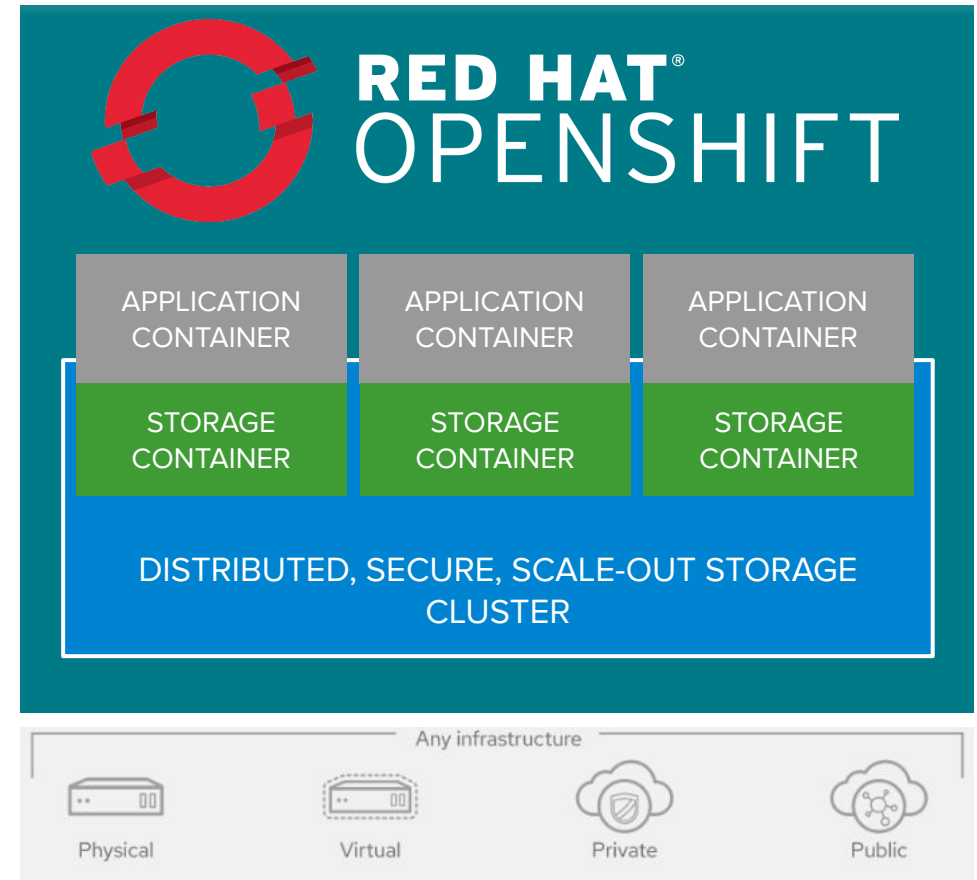
STORAGE SUPPORT BEFORE OCS

NFS*

GlusterFS

VMDK ***

Cinder ***

Ceph RBD ***

RED HAT®
VIRTUALIZATION

vmware®

RED HAT®
OPENSTACK®
PLATFORM

OPENSHIFT MASTERS

OPENSHIFT NODES

OPENSHIFT CLUSTER

RED HAT®
ENTERPRISE LINUX®

Google Cloud Platform

Microsoft Azure

amazon web services

GCE Persistent Disk **/***

Azure File *

Azure Block **/***

AWS EBS **/***

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No dynamic provisioning   ** *No Cross-Availability Zone Support*   *** *No Shared-Storage*

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STORAGE SUPPORT AFTER OCS

Scalable
(1000+ volumes)

Highly-Available
(across availability zones)

Persistent, resilient and elastic storage...

OPENSHIFT MASTERS

OPENSHIFT NODES WITH STORAGE

Gluster Cluster N

Gluster Cluster 1

RED HAT
OPENSHIFT
Container Storage

Gluster Cluster 0

OPENSHIFT NODES

OPENSHIFT CLUSTER

RED HAT®
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Automated
(Dynamic Provisioning)

Integrated
(installs with / runs on OpenShift)

... that travels with the platform.

* No dynamic provisioning   *** No Cross-Availability Zone Support*   **** No Shared-Storage*

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TWO FLAVORS OF CONTAINER STORAGE
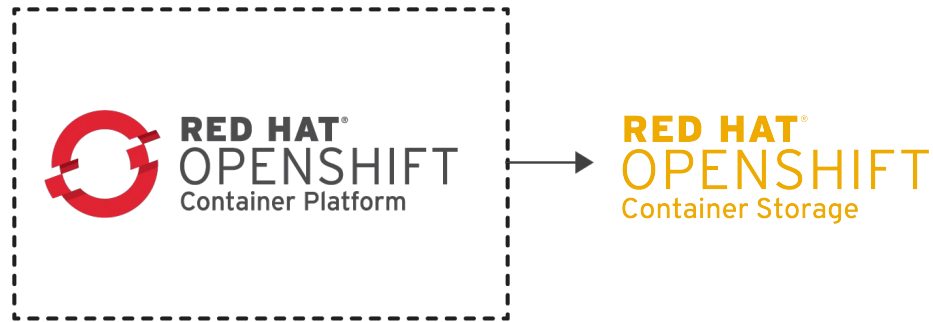
OPENSHIFT CONTAINER STORAGE
INDEPENDENT MODE

Use existing investment in traditional storage,
managed by storage admin – attach to standalone storage
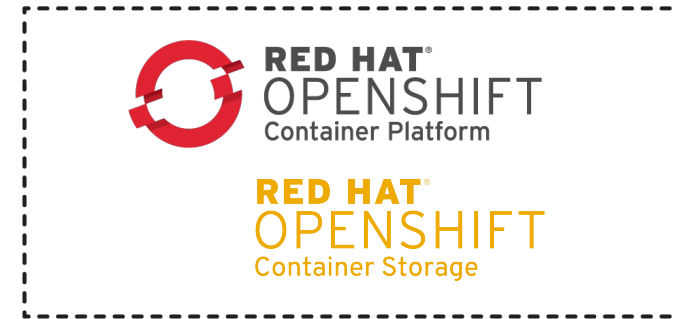
OPENSHIFT CONTAINER STORAGE
CONVERGED MODE

Highly scalable, enterprise-grade storage,
fully integrated into OpenShift Container Platform

CONVERGED MODE

OPENSHIFT NODE 1

APP CONTAINER

MASTER

RED HAT
OPENSHIFT
Container Platform

OPENSHIFT NODE 2

APP Container

OCS Container

OPENSHIFT NODE 3

APP Container

OCS Container

RED HAT
OPENSHIFT
Container Storage

OCS Container

OPENSHIFT NODE 4
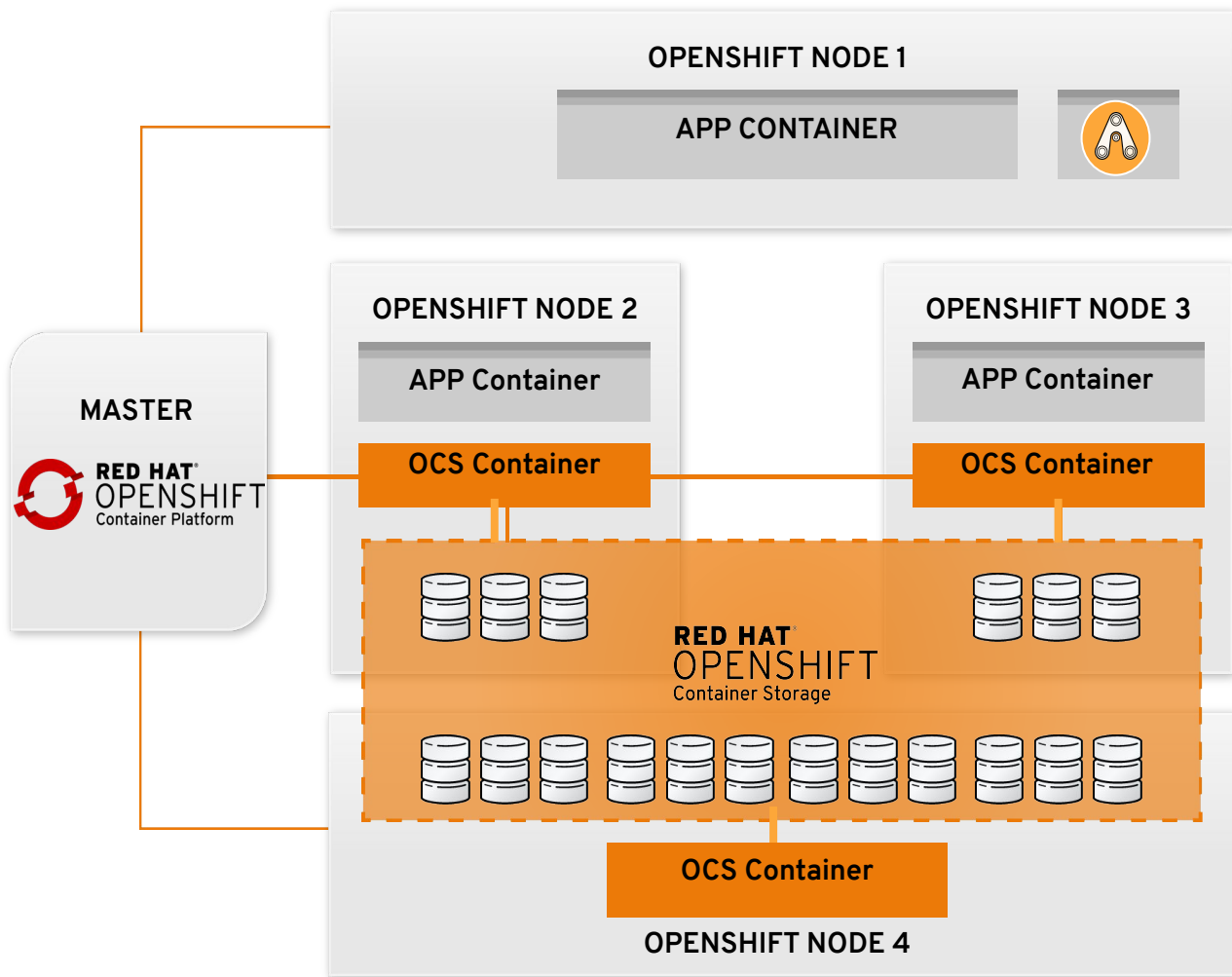
Co-Locate Storage and Apps

Dynamic Provisioning

Managed by OpenShift

Infrastructure-Agnostic

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STORAGE CONSOLIDATION IN THE CLOUD

EBS sc1

EBS gp2

EBS gp2

EBS st1

EBS io1

VS.

RED HAT®
OPENSHIFT
Container Platform

RED HAT®
OPENSHIFT
Container Storage
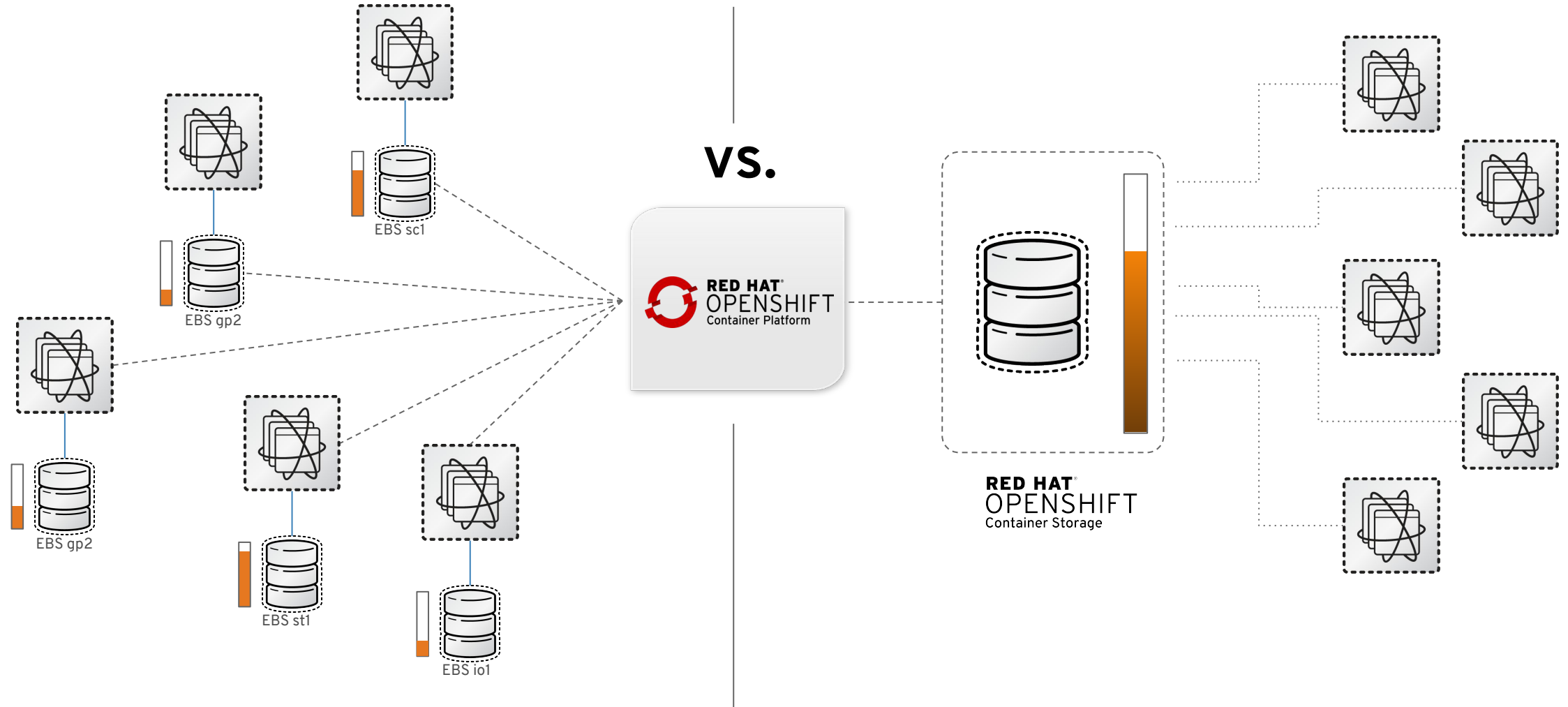
STORAGE CONSOLIDATION ON PREM
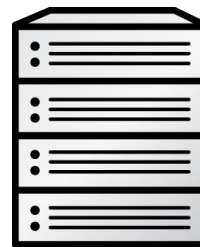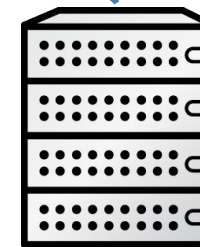
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