



# MANAGING UNSTRUCTURED DATA AT PETABYTE-SCALE

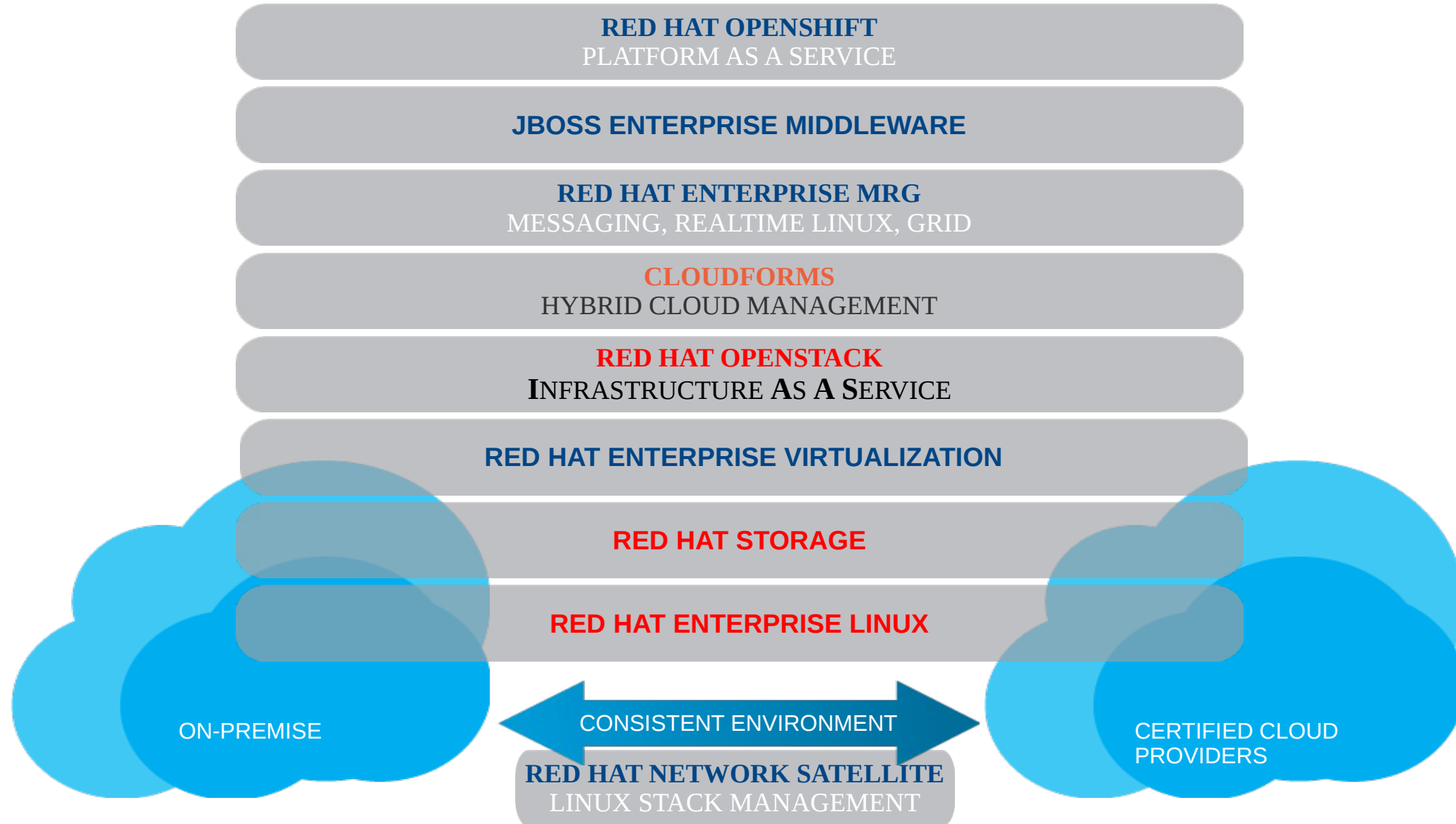
Joachim Schröder

Manager Solution Architects, DACH

Email: [joachim.schroeder@redhat.com](mailto:joachim.schroeder@redhat.com)

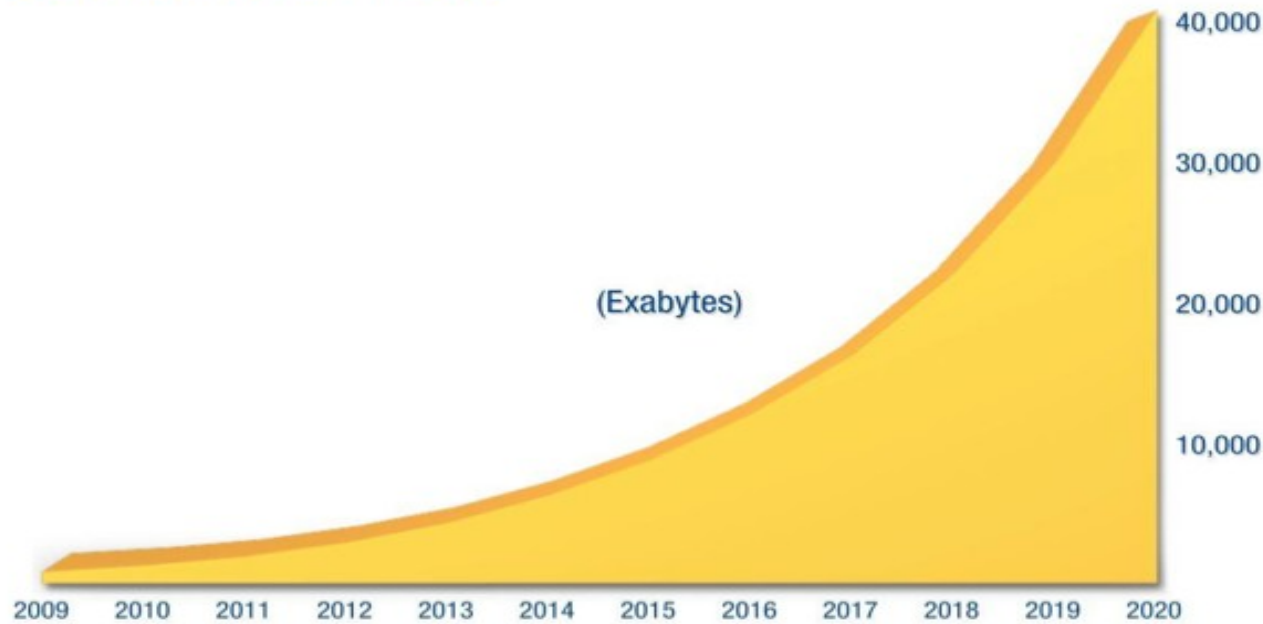
November, 14th 2013

# WHO'S RED HAT? - RED HAT PORTFOLIO

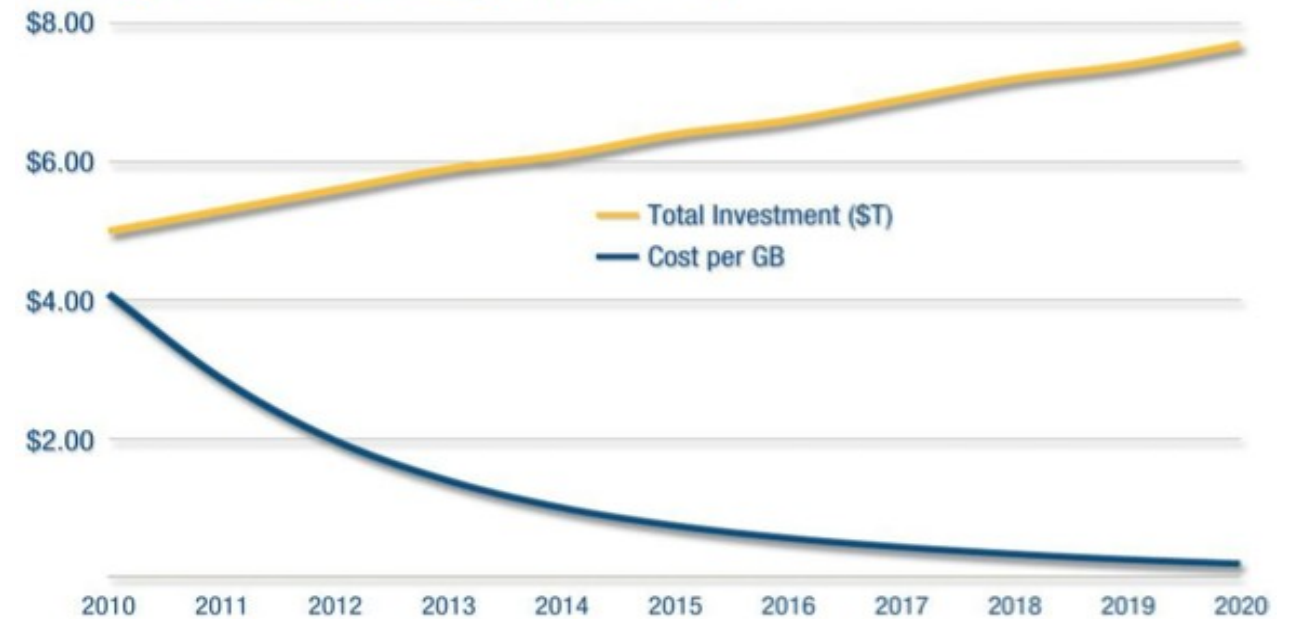


# THE INFORMATION EXPLOSION

The Digital Universe: 50-fold Growth from the Beginning of 2010 to the End of 2020



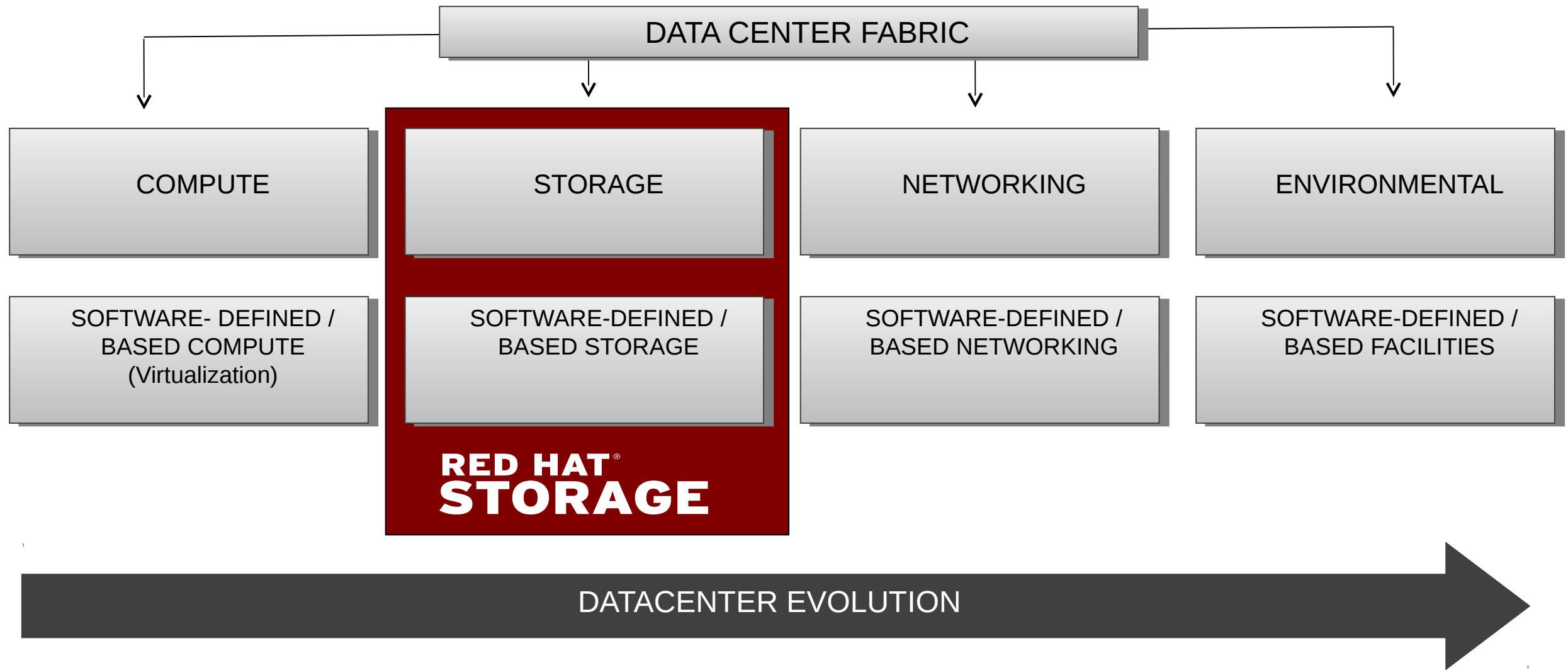
The Digital Universe Paradox: Falling Costs and Rising Investment



Source: IDC's Digital Universe Study, Dec 2012

Main growth drivers:  
Virtualisation, Cloud, Mobile Computing and Big Data

# CORNERSTONE OF THE NEW SOFTWARE DEFINED DATACENTER



# WHAT IS RED HAT STORAGE?

OpenSource

**Scale-out NAS** (Network Attached Storage)

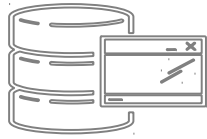
deployable on

on-premise, virtualized and Cloud environments

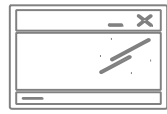
based on GlusterFS

running on standard x86 Hardware

# INCREASE DATA, APPLICATION AND INFRASTRUCTURE AGILITY



DATA SERVICES



ENTERPRISE APPLICATIONS



BIG DATA WORKLOADS



CLOUD APPLICATIONS



ENTERPRISE MOBILITY

**RED HAT®  
STORAGE**

FILE SERVICES

OPEN OBJECT APIs

CONVERGED COMPUTE AND STORAGE

OPEN, SOFTWARE-DEFINED STORAGE PLATFORM

PHYSICAL



Standard x86 systems  
Scale-out NAS solutions

VIRTUAL



Include idle or  
legacy resources

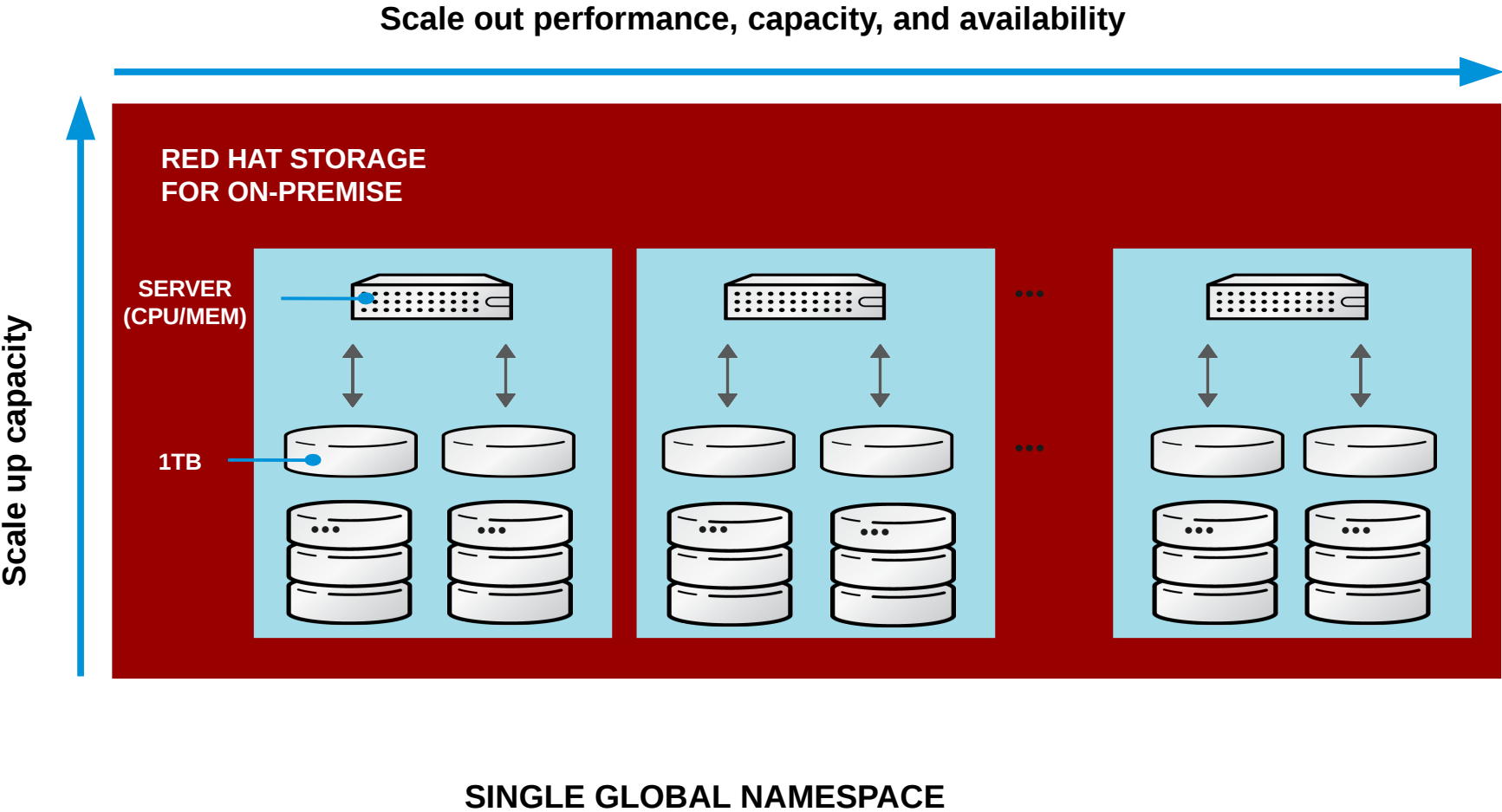
CLOUD



SCALE-OUT STORAGE  
ARCHITECTURE

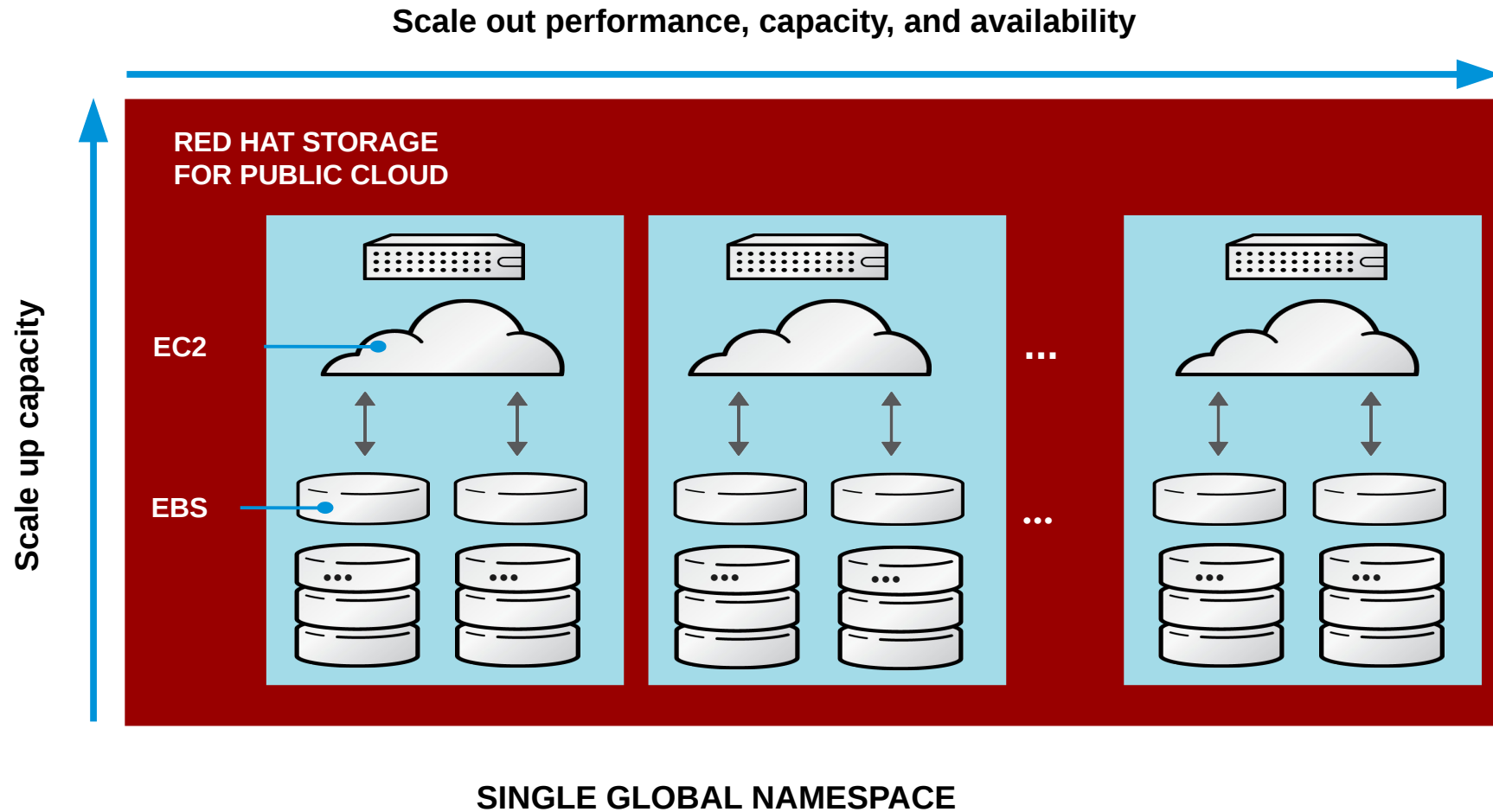
PERSISTENT DATA STORES

# RED HAT STORAGE DEPLOYMENT ON-PREMISE



- Single namespace
- Aggregates CPU, memory, network capacity.
- Deploys on Red Hat-supported servers and underlying storage: DAS, JBOD.
- Scale out linearly.
- Scale out performance and capacity as needed.
- Replicate synchronously and asynchronously.

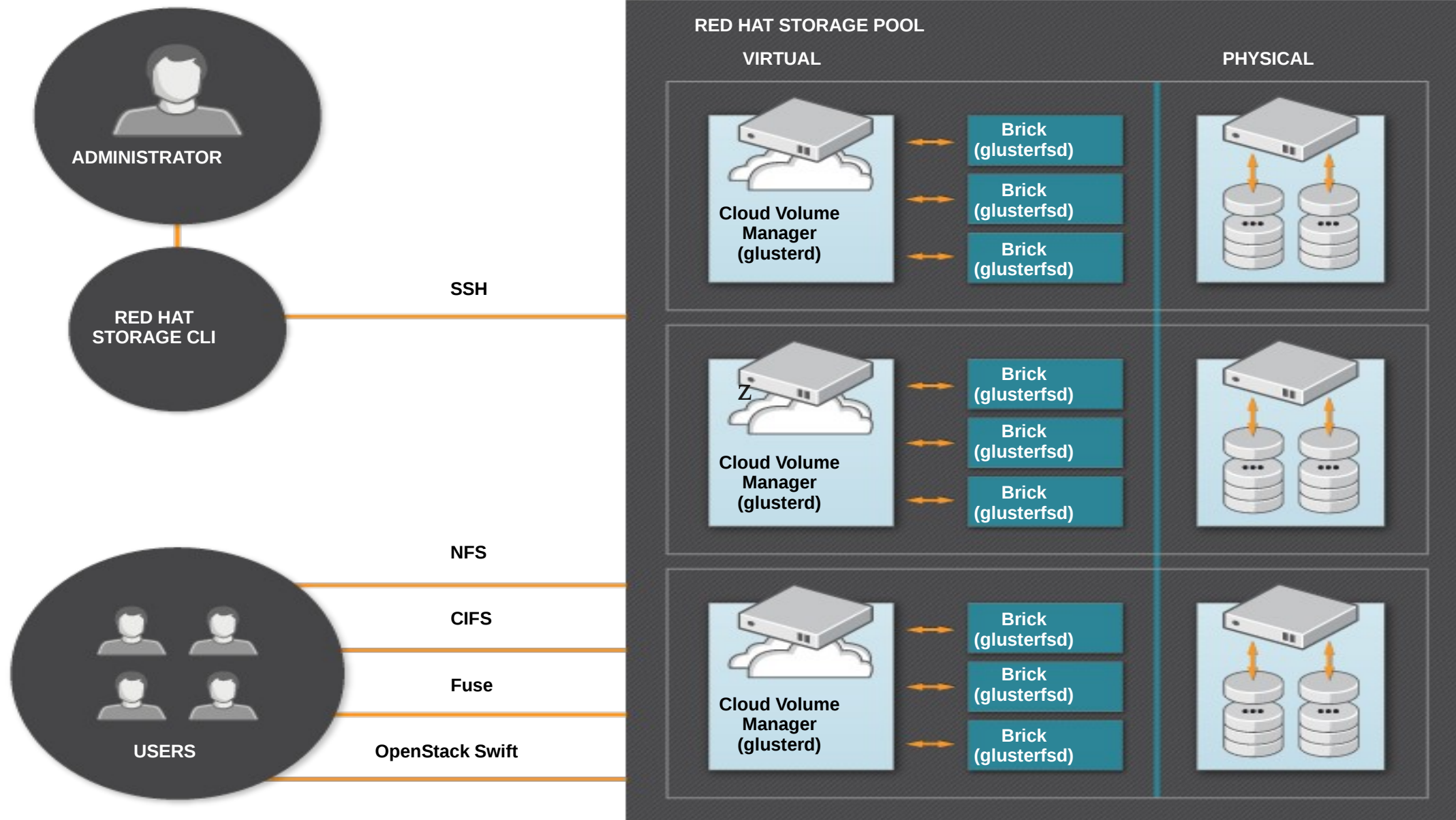
# RED HAT STORAGE DEPLOYMENT ON AMAZON CLOUD



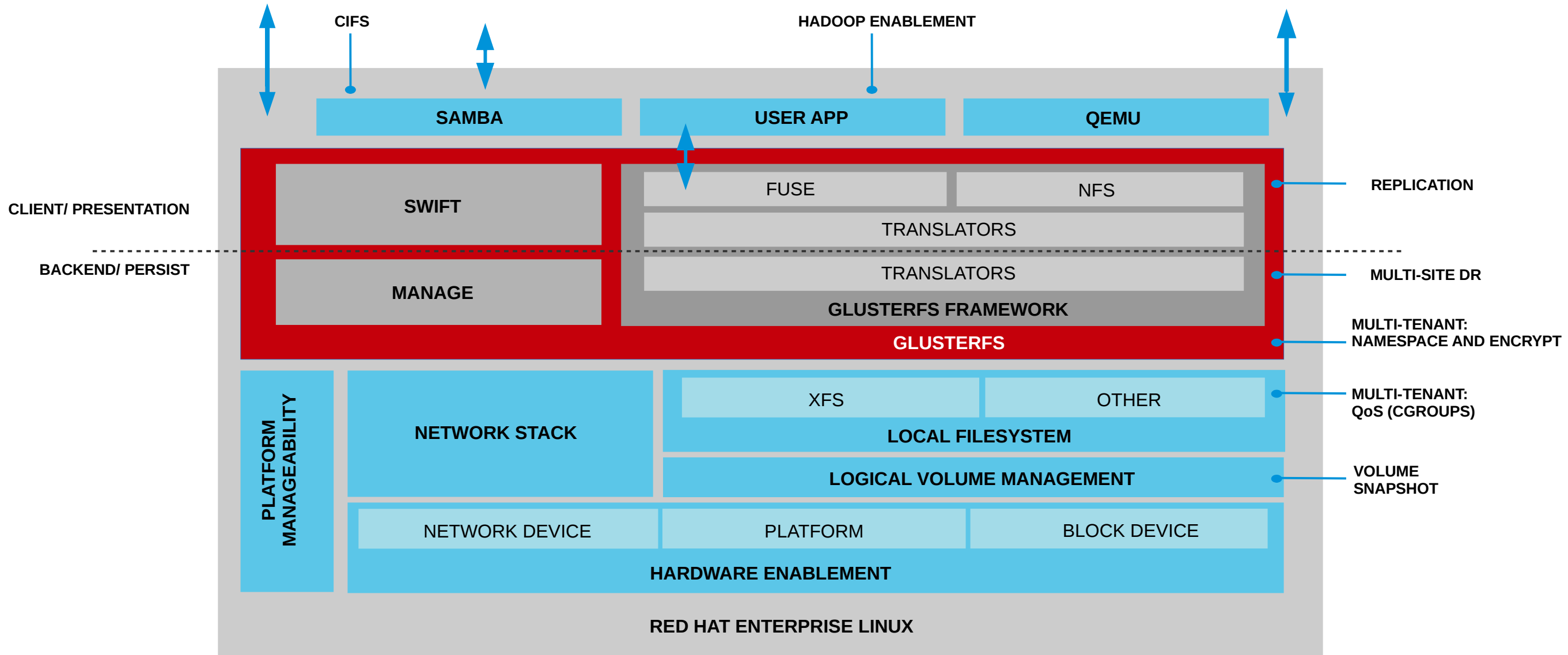
- GlusterFS Amazon Machine Images (AMIs)
- The only way to achieve high availability of Elastic Block Storage (EBS)
- Multiple EBS devices pooled
- POSIX compatible (no application to rewrite required to run on Amazon EC2)
- Scale out capacity and performance as needed



# RED HAT STORAGE—50,000 FOOT OVERVIEW

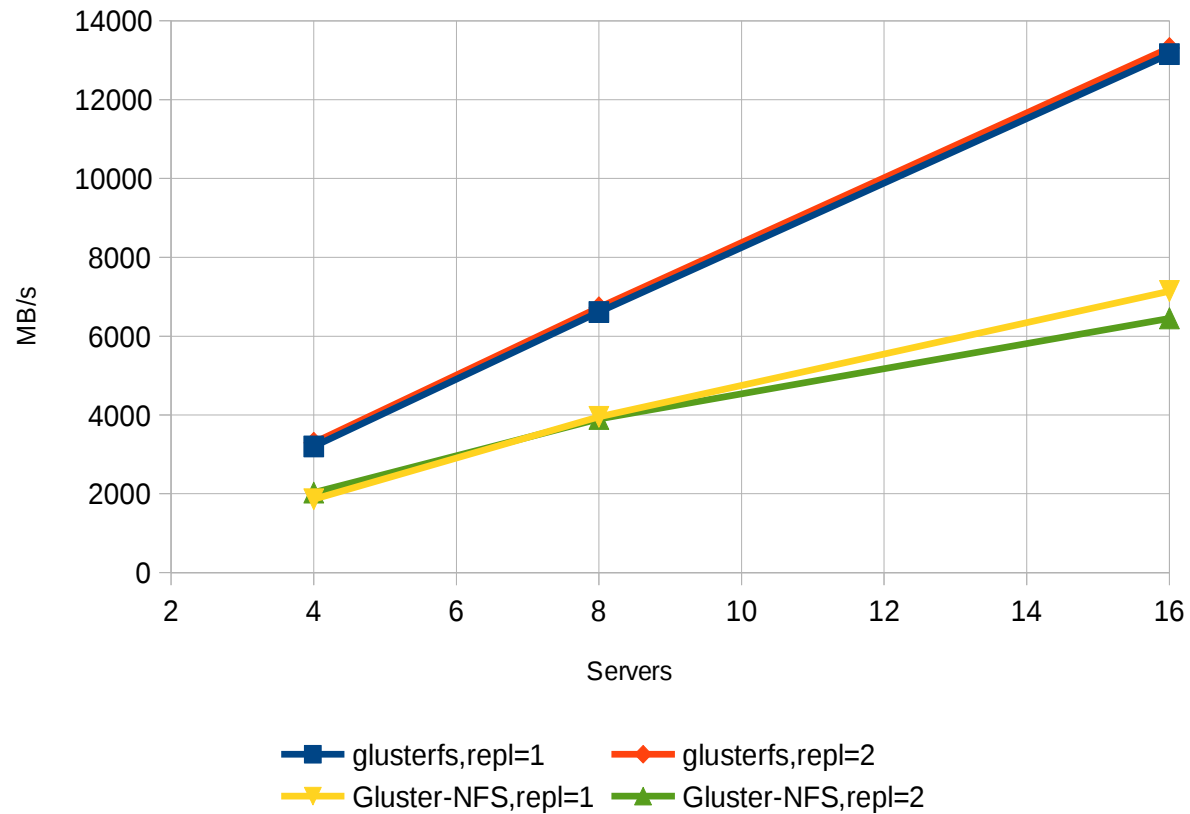


# RED HAT STORAGE TECHNOLOGY STACK

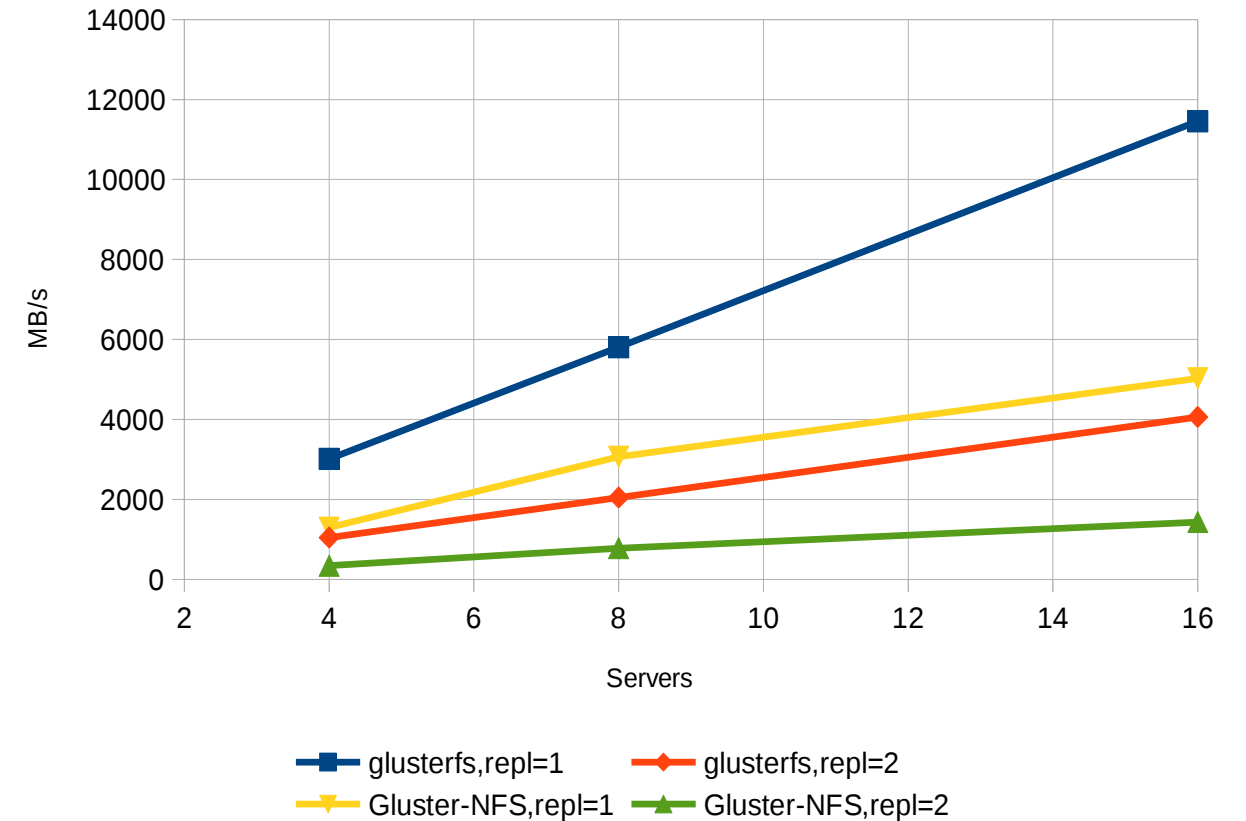


# RED HAT STORAGE SCALABILITY

## Sequential Read Transfer Rates



## Sequential Write Transfer Rates



# RHS-C Management Console

The screenshot shows the Red Hat Storage Console web interface. The browser address bar displays the URL: `dhcp159-153.sbu.lab.eng.bos.redhat.com/webadmin/webadmin/WebAdmin.html#volumes-bricks`. The user is logged in as `admin@internal`. The interface includes a search bar with the text "Volumes:" and a navigation menu with tabs for Clusters, Servers, Volumes, and Users. The "Volumes" tab is active, showing a table of volumes:

| Name  | Volume Type | Number of Bricks | Transport Type | Status |
|-------|-------------|------------------|----------------|--------|
| music | Distribute  | 2                | TCP            | Up     |
| video | Replicate   | 2                | TCP            | Up     |

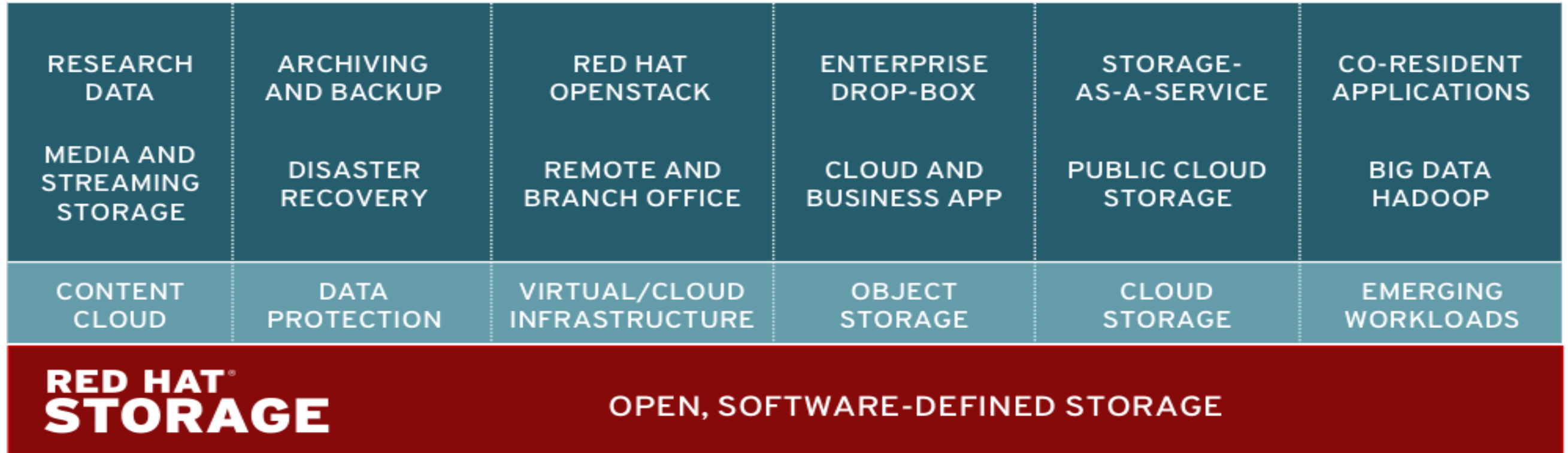
Below the volume table, the "Bricks" sub-tab is selected, displaying a table of bricks for the "music" volume:

| Server        | Brick Directory   | Status |
|---------------|-------------------|--------|
| 10.16.159.159 | /tmp/music-brick1 | Up     |
| 10.16.159.161 | /tmp/music-brick2 | Up     |

The interface also features a left-hand navigation tree with "System", "Clusters", "Servers", and "Volumes" sections. A status bar at the bottom shows a message: "Last Message: 2012-Jun-05, 13:51:33 Gluster Volume video started." and includes icons for "2 Alerts", "Events", and "Tasks (0)".

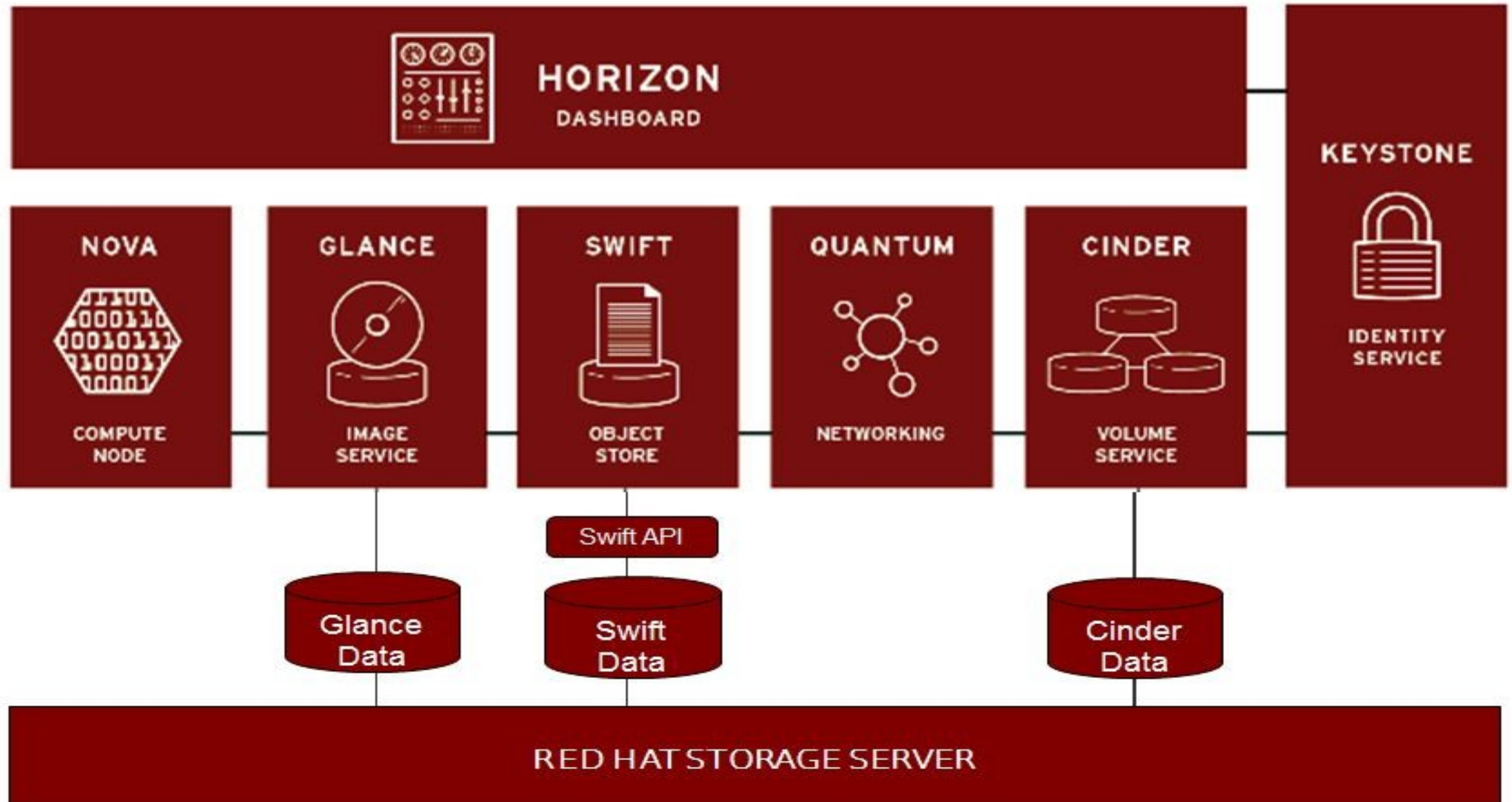
# DESIGNED FOR MANAGING UNSTRUCTURED DATA

## SUPPORTING A WIDE RANGE OF ENTERPRISE AND EMERGING WORKLOADS



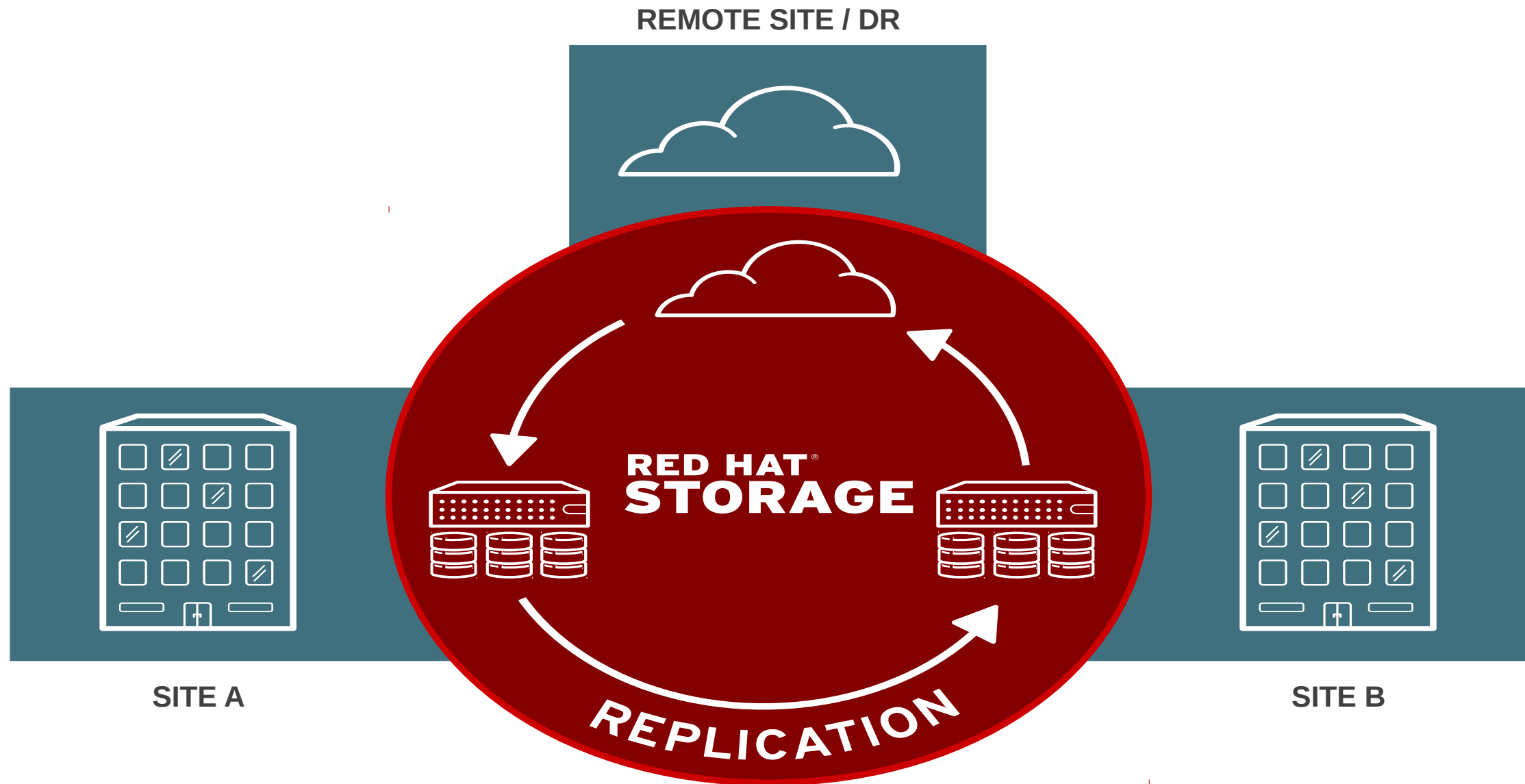


# RED HAT STORAGE FOR OPENSTACK



# ENSURE GLOBAL DATA PROTECTION AND AVAILABILITY

## TRANSPARENTLY DISTRIBUTE DATA GLOBALLY



# BRING APPLICATIONS CLOSER TO THE DATA

## CONVERGING COMPUTE AND STORAGE



REDUCE LATENCY

PROCESS DATA LOCALLY

REDUCE COSTS

INCREASE AGILITY

STORAGE RESIDENT APPLICATIONS



# HIGHLY AVAILABLE CLOUD STORAGE FOR AMAZON EC2

LEVERAGE THE ELASTICITY OF THE CLOUD WITHOUT RE-WRITING YOUR APPLICATIONS

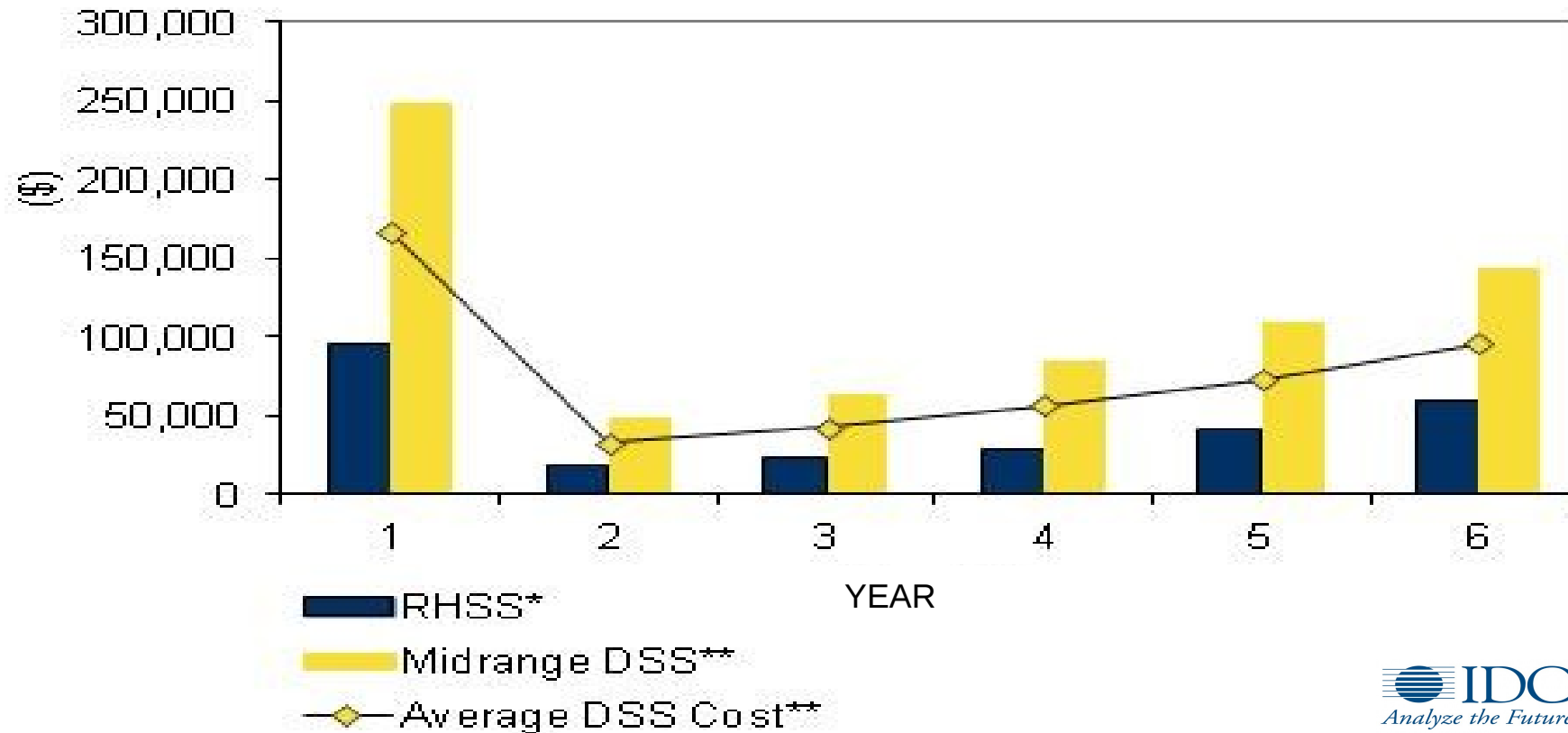


CREATING HIGHLY AVAILABLE, SCALEABLE EBS STORAGE POOLS - ACROSS ZONES

**Now available as AWS test-drive**

# DELIVER COST EFFECTIVE ELASTIC CAPACITY AND PERFORMANCE

**53% - 78% REDUCTION IN COSTS**



SOURCE: IDC REPORT – THE ECONOMICS OF SOFTWARE BASED STORAGE

# MANAGING SPRAWLING UNSTRUCTURED FINANCIAL DATA



“Red Hat worked with us the entire way as we designed and built our architectures, helping with best practices, design considerations and layout, performance testing, and migration.”

MOHIT ANCHLIA  
ARCHITECT, INTUIT TURBO TAX

## PROBLEM

- NEEDED A FAST, RELIABLE, AND COST-EFFECTIVE STORAGE SOLUTION TO MEET GROWING SAAS LINE OF BUSINESS
- TAX RETURNS AND OTHER DATA WERE BEING STORED AS BLOBS IN AN EXPENSIVE ORACLE DB

## SOLUTION

- RED HAT STORAGE SERVER 2.0 FOR ON-PREMISE OBJECT STORAGE
- HP DL2000s AND APACHE CASSANDRA

## BENEFITS

- SCALEABLE ON-DEMAND STORAGE FOR UNSTRUCTURED DATA
- COST EFFECTIVE SOLUTION THAT LEVERAGES COMMODITY HARDWARE
- MEET GROWING CAPACITY AND PEAK PERFORMANCE NEEDS
- ACHIEVE MULTI-SITE DISASTER RECOVERY

# IS THE OPPORTUNITY REAL ?

**SearchStorage** TechTarget

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Home > Topics > Data Storage Management > Data management tools > Red Hat Gluster will transform storage market, IDC analyst predicts

## Red Hat Gluster will transform storage market, IDC analyst predicts

Carol Sliwa Published: 08 Aug 2013

**ESSENTIAL GUIDE** **RED HAT STORAGE SERVER SEEKS TO MIMIC SUCCESS OF ENTERPRISE LINUX**

This article is part of an Essential Guide, our editor-selected collection of our best articles, videos and other content on this topic. Explore more in this guide:

1. - **IDC'S NADKARNI PREDICTS MAINSTREAM ACCEPTANCE : READ MORE IN THIS SECTION**  
▶ **GlusterFS-based software will drive mainstream acceptance of software-based storage**

**Explore other sections in this guide:**

2. - Wikibon's Floyer: Manageability work needed
3. - Staimer foresees limited appeal

*Red Hat Inc. will eventually turn the market "on its head" with its Red Hat GlusterFS-based storage software in the same way that it successfully challenged major server operating system vendors with its distribution of enterprise Linux, an IDC analyst predicted.*

*Ashish Nadkarni, a research director in the storage systems practice at Framingham, Mass.-based International Data Corp. (IDC), said Red Hat may need a few years to realize its vision of converting commodity hardware into a full-fledged storage platform.*

*But Nadkarni thinks Red Hat Gluster will challenge scale-out, file-based storage systems from major vendors as well as combined compute-storage platforms that cater to the high-performance computing market with data analytics software.*

**LISTEN TO THE ENTIRE PODCAST SERIES ABOUT RED HAT'S CHANCES WITH ITS STORAGE SERVER SOFTWARE**

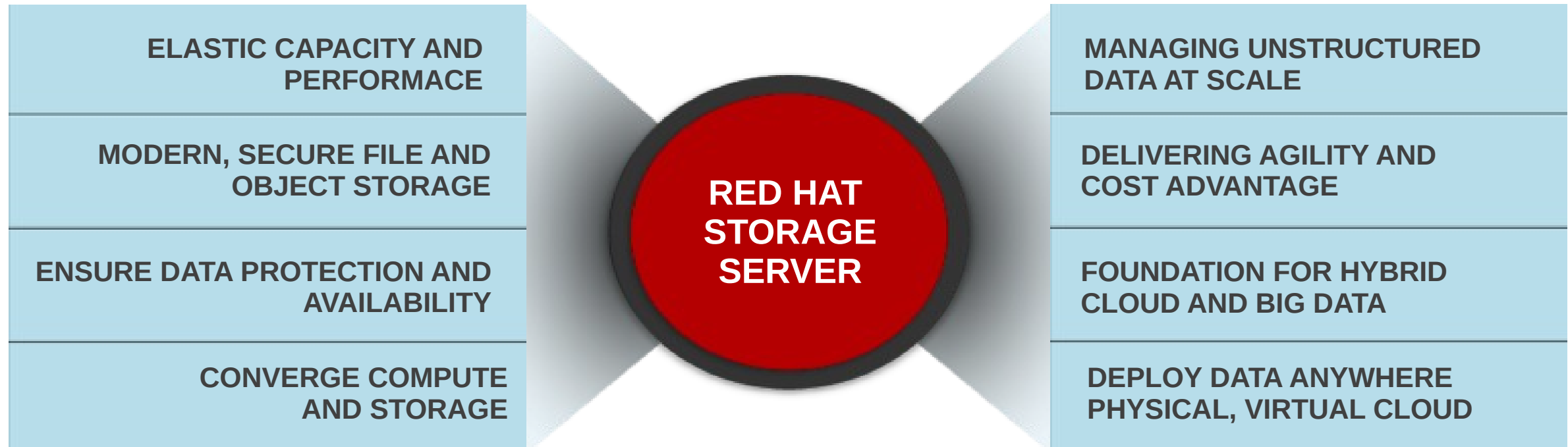
Red Hat's open source software-based storage holds appeal mainly for passive data

With push into software-based storage, Red Hat will help drive down cost of storage features

### Latest News

- 1. EMC Corp. prepares VNX2 launch
- 2. Scality CEO: Object-oriented storage needs multiple access methods
- 3. Coraid Inc. NAS gets more cache for heavy I/O loads
- 4. Riverbed Granite storage box gets Fibre Channel support
- 5. Emerging data storage trends embraced by BNY Mellon IT infrastructure

# DELIVERING THE NEXT GENERATION OF OPEN SOFTWARE-DEFINED STORAGE TODAY



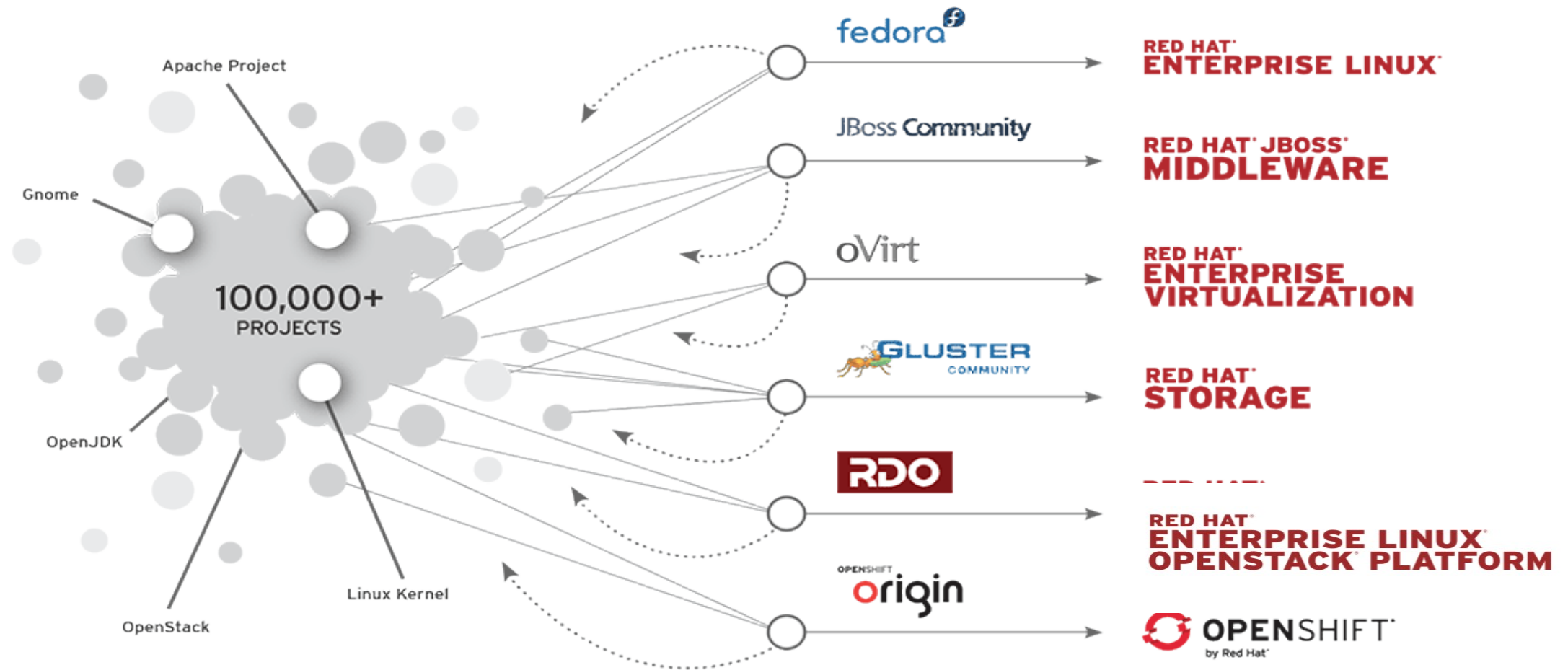
**DESIGNED FOR TODAY'S IT & DATA ECONOMICS**

# RED HAT STORAGE – DEVELOPING 3<sup>rd</sup> PARTY ECO-SYSTEM





# RED HAT LEADS THROUGH OPEN INNOVATION



# COMMUNITY INNOVATION

## GLUSTER.ORG COMMUNITY FORGE ENHANCEMENTS AND PROJECTS

SNAPSHOTTING

CHANGE DETECTION

COMPRESSION

3-WAY REPLICATION

pNFS AND NFSv4 SUPPORT

FILE VERSIONING

ERASURE CODING

MULTI-MASTER GEO-REPLICATION

The screenshot shows the Gluster Community Forge website. At the top, there is a navigation bar with links for "Gluster Home", "Dashboard", "Register", and "Login". Below this, there are links for "Activities", "Projects", and "Teams", along with a search bar. A large orange banner contains a welcome message: "Welcome to the Gluster Community Forge, the home of Open Source software-defined storage development. Read more" and a link: "-> Download GlusterFS -> GlusterFS Home". Below the banner, there are two main sections: "Flagship Projects" and "Incubating Projects".

**Flagship Projects**

- GlusterFS Core**  
This is the core platform for GlusterFS, providing all the major feature functionality.  
[Project Home](#) | [Developer Home](#) | [Documentation](#)

**Incubating Projects**

- pmux**  
Pmux is a lightweight file-based MapReduce system, written in Ruby. Applying the philosophy of Unix pipeline processing to distributed computing on a GlusterFS cluster, pmux provides a tool capable of handling large amounts of data stored in files.  
[Project Home](#) | [Developer Home](#) | [Documentation](#)
- glocator**  
glocator is a daemon for providing responses to queries against file locations of GlusterFS.  
[Project Home](#) | [Developer Home](#) | [Documentation](#)
- Samba-Gluster Integration**  
GlusterFS integration for Samba. From

**From Planet Gluster**

- Gluster Community Day at Portland – July 23**  
We have an amazing community day scheduled in Portland, OR, on July 23. If you're in town for OSCON, swing by – we'll be at the Mission Theater, which is close to the MAX for easy access. Here are just a few of the highlights: Theron ...  
Thu, 11 Jul 2013 20:56:28 +0000
- The Summer of Gluster is Here!**  
I wanted to take a moment and share all the things that are going on in the Gluster Community. It really has been an amazing year, and we're only halfway through. Here's a recap for those of you watching from home: Launched the Gluster Comm...  
Thu, 11 Jul 2013 19:47:06 +0000
- Performance Measurement Pitfalls**  
One of the problems with measuring and comparing performance of scalable systems is that any workload capable of producing meaningful results is going to be highly multi-threaded, and most developers don't know much about how to collect or interpret th...  
Wed, 10 Jul 2013 00:03:00 +0000

SMB 3.0 SUPPORT

NDMP SERVER

PUPPET MANAGEMENT MODULE

GTOP - MONITORING

GLUSTER PROFILING

SELINUX SUPPORT

PMUX – LIGHTWEIGHT MAP REDUCE

TRANSLATORS EXTENSION FOR PYTHON



# RED HAT STORAGE INFORMATION RESOURCES

## **RED HAT STORAGE PRODUCT INFORMATION**

[HTTP://WWW.REDHAT.COM/PRODUCTS/STORAGE-SERVER/](http://www.redhat.com/products/storage-server/)

## **RED HAT STORAGE SOLUTIONS**

[HTTP://WWW.REDHAT.COM/PROMO/LIBERATE/SOLUTIONS.HTML](http://www.redhat.com/promo/liberate/solutions.html)

## **RED HAT STORAGE CUSTOMER SUCCESS STORIES**

[HTTP://WWW.REDHAT.COM/PROMO/LIBERATE/RESOURCES.HTML](http://www.redhat.com/promo/liberate/resources.html)

## **RED HAT STORAGE SERVICES**

[HTTP://WWW.REDHAT.COM/PROMO/LIBERATE/SERVICES.HTML](http://www.redhat.com/promo/liberate/services.html)

## **GLUSTER COMMUNITY**

[HTTP://WWW.GLUSTER.ORG](http://www.gluster.org)

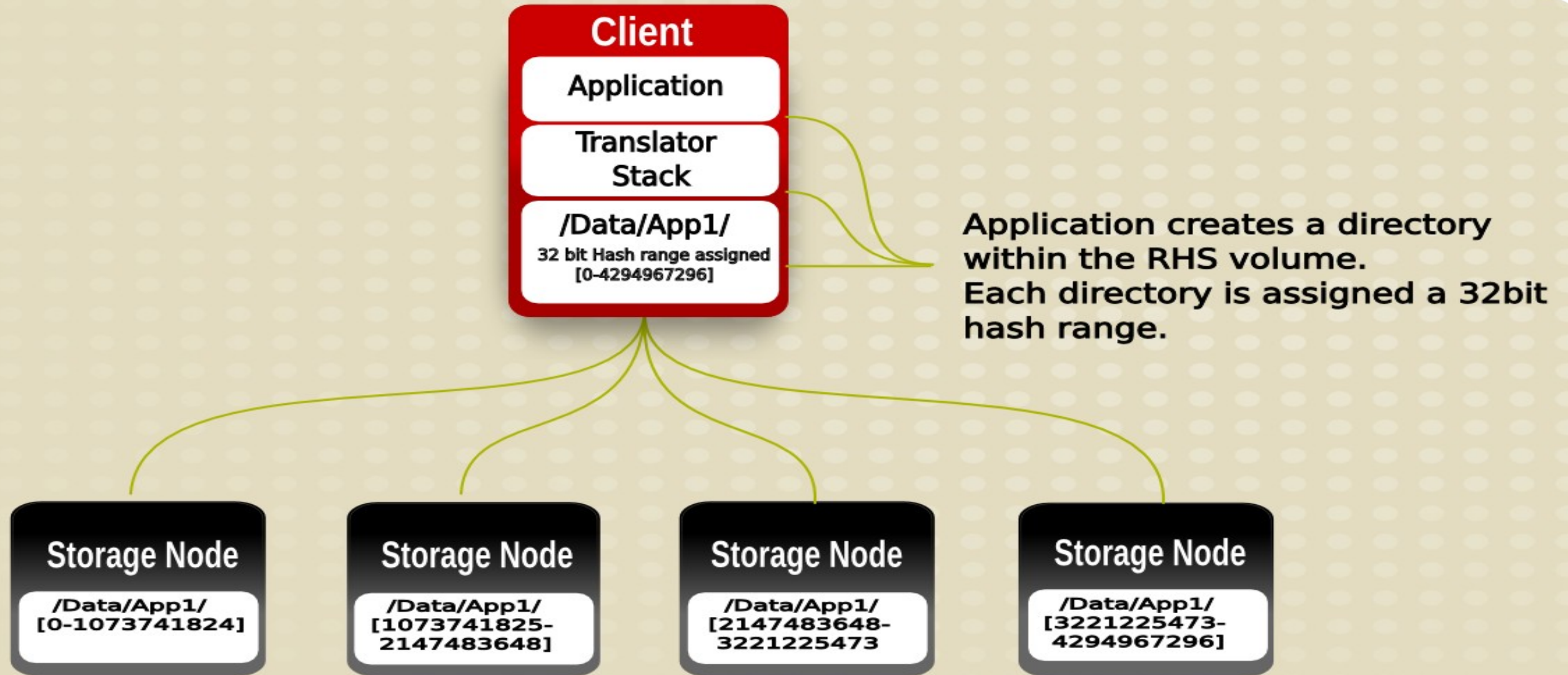
## **GLUSTER COMMUNITY FORGE**

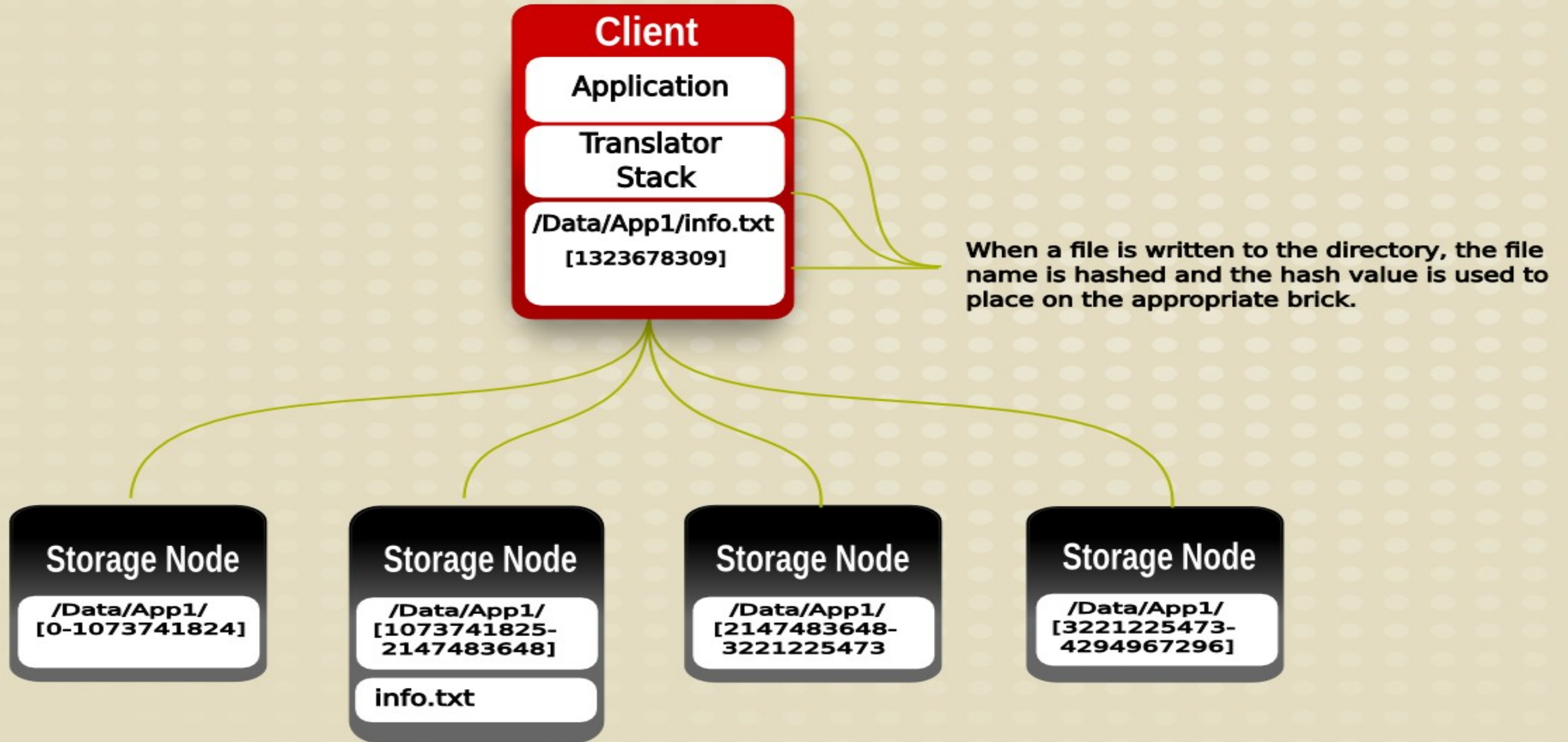
[HTTP://FORGE.GLUSTER.ORG](http://forge.gluster.org)

# BACKUP

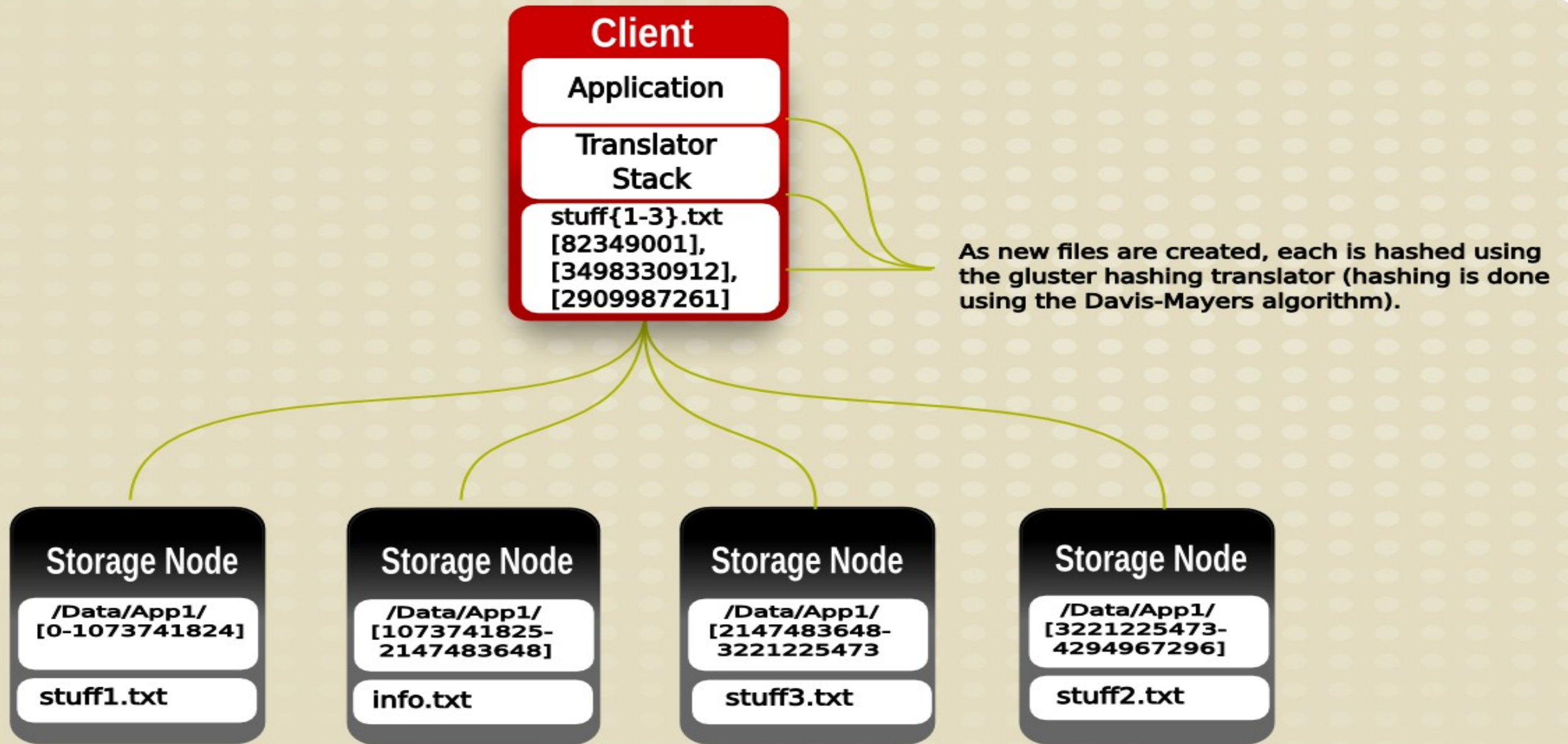
# How Does GlusterFS Work Without Metadata?

- Files are placed on a brick(s) in the cluster based on a calculation
- All native clients have an algorithm built-in
- All storage nodes have an algorithm built-in
- Files can then be retrieved based on the same calculation
- For non-native clients, the server handles retrieval and placement

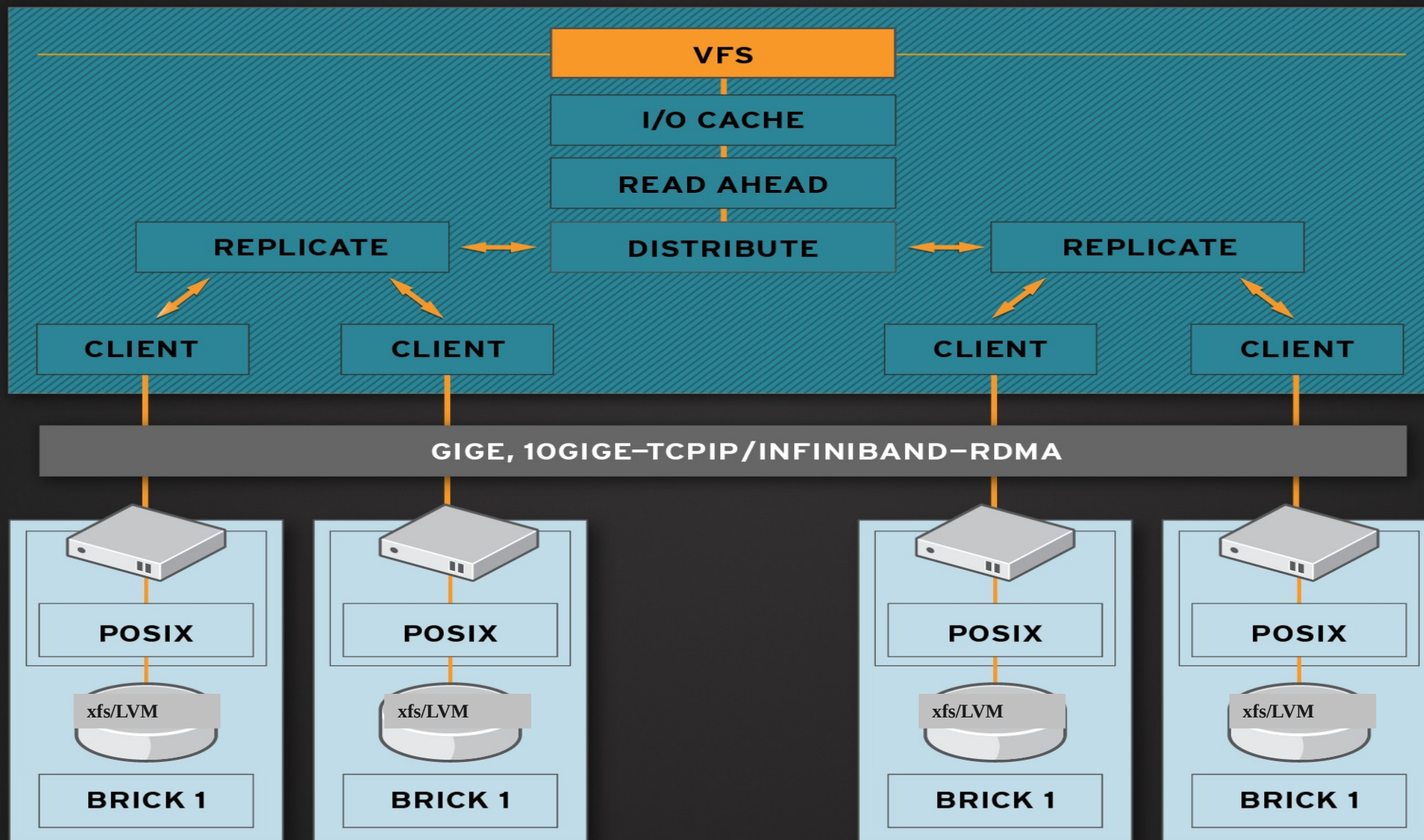






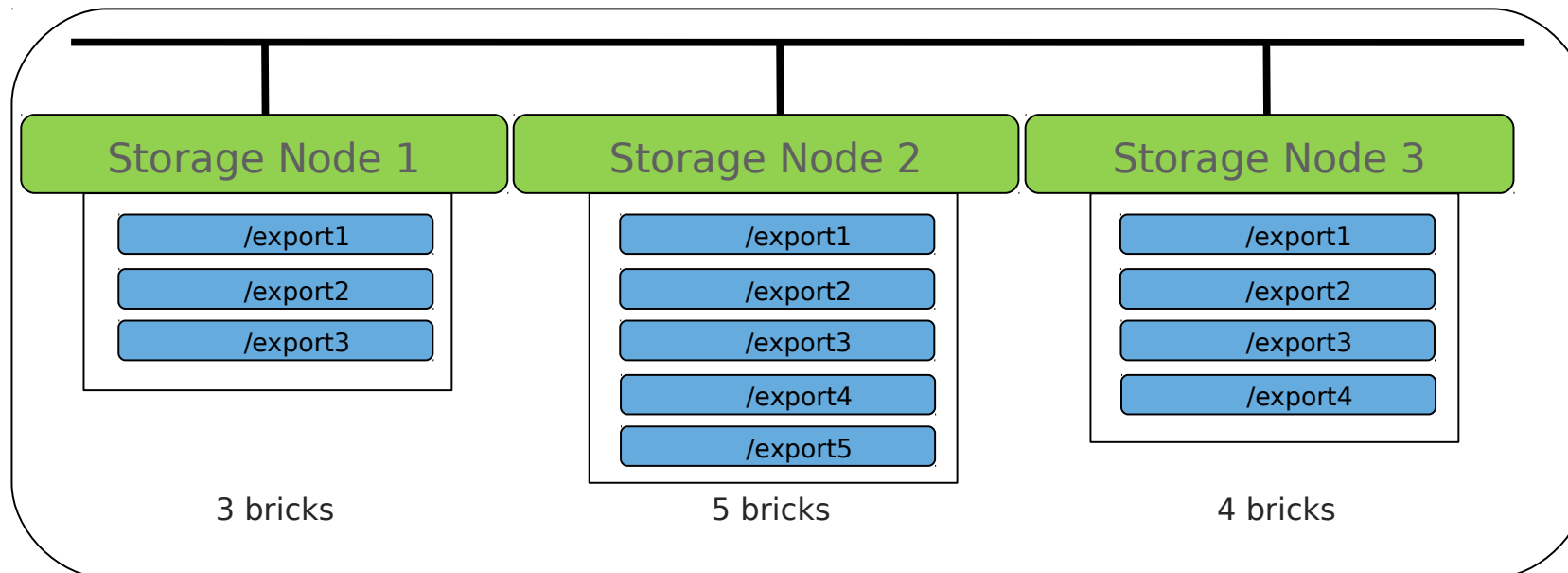


# STACKABLE DESIGN-ELASTIC HASHING



# Bricks

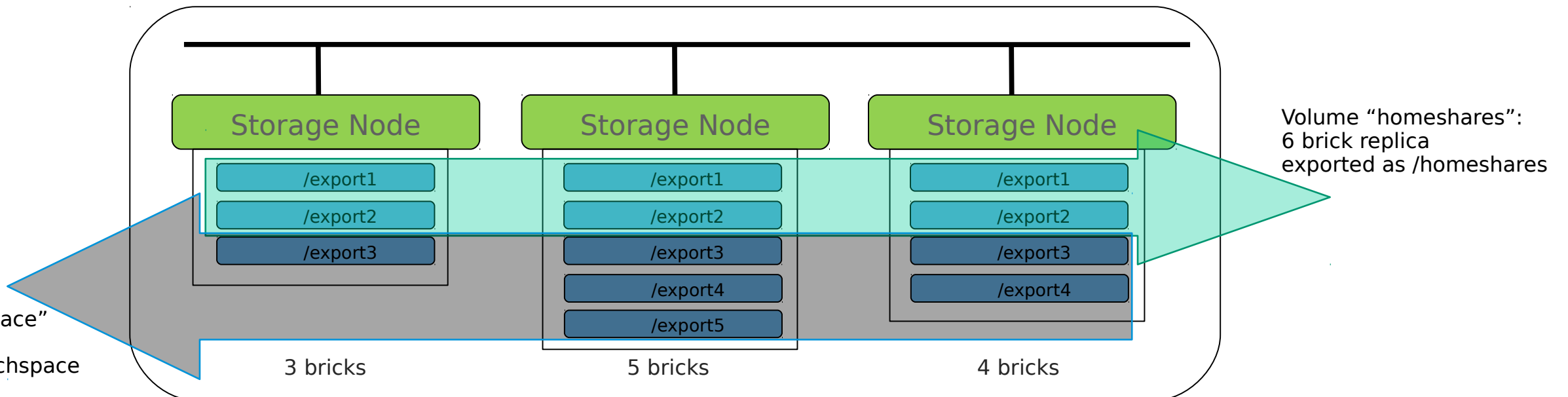
- A brick is the combination of a node and a file system: hostname:/dir
- Each brick inherits limits of the underlying filesystem(xfs)
- RHS operates at the brick level, not at the node level
- Ideally, each brick in a cluster should be the same size





# Volumes

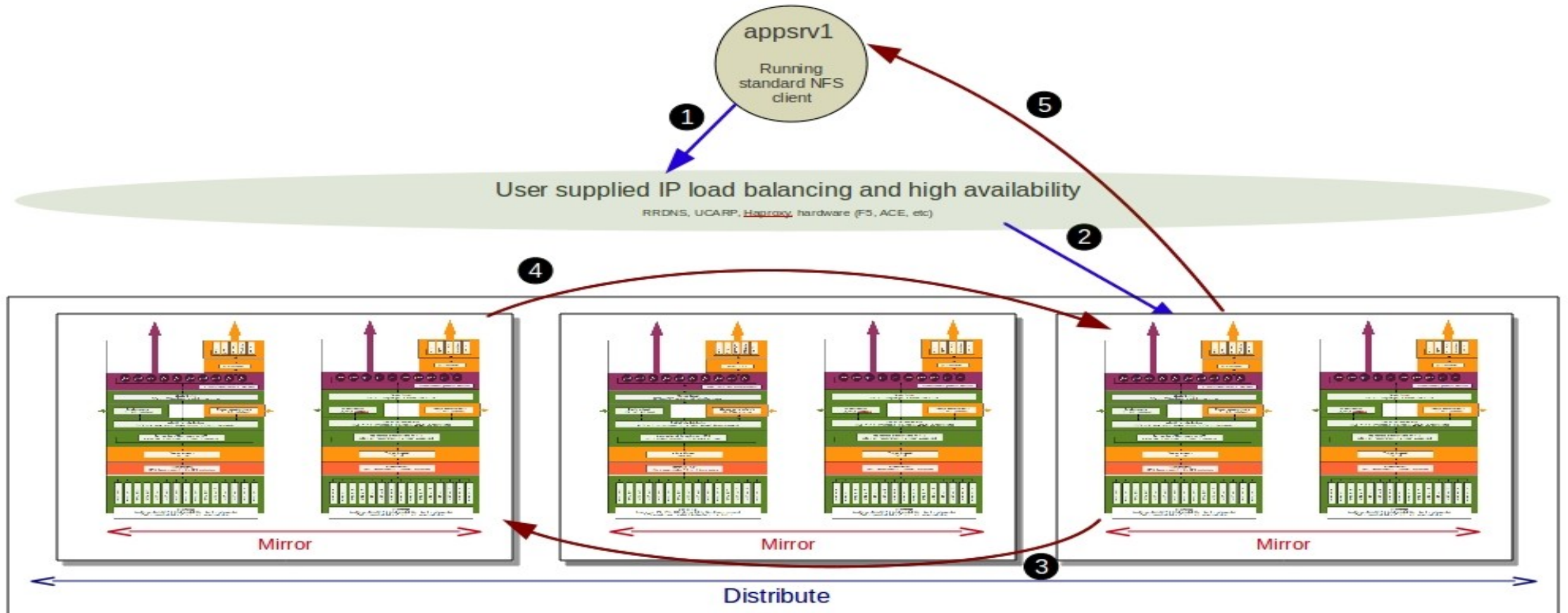
- A volume consists of 1 or more bricks => exported with Gluster.
  - volumes have administrator assigned export names
  - a brick is a member of only one volume
- A namespace can have 1 or more volumes
  - A namespace can consist of replicated and distributed volumes
  - data in different volumes physically exists on different bricks
  - volumes can be mounted on clients using NFS, CIFS and/or GlusterFS clients (native FUSE client)



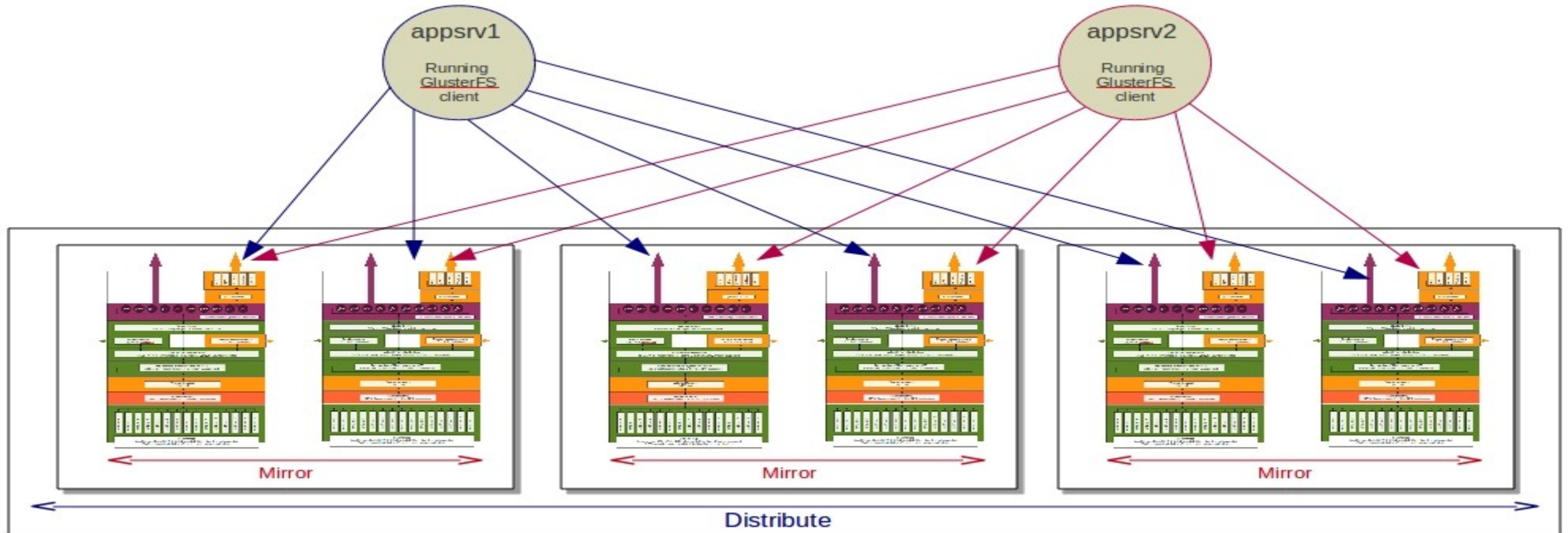
Volume "scratchspace"  
6 brick distribute,  
exported as /scratchspace

Volume "homeshares":  
6 brick replica  
exported as /homeshares

# Data Flow with NFS/CIFS Client

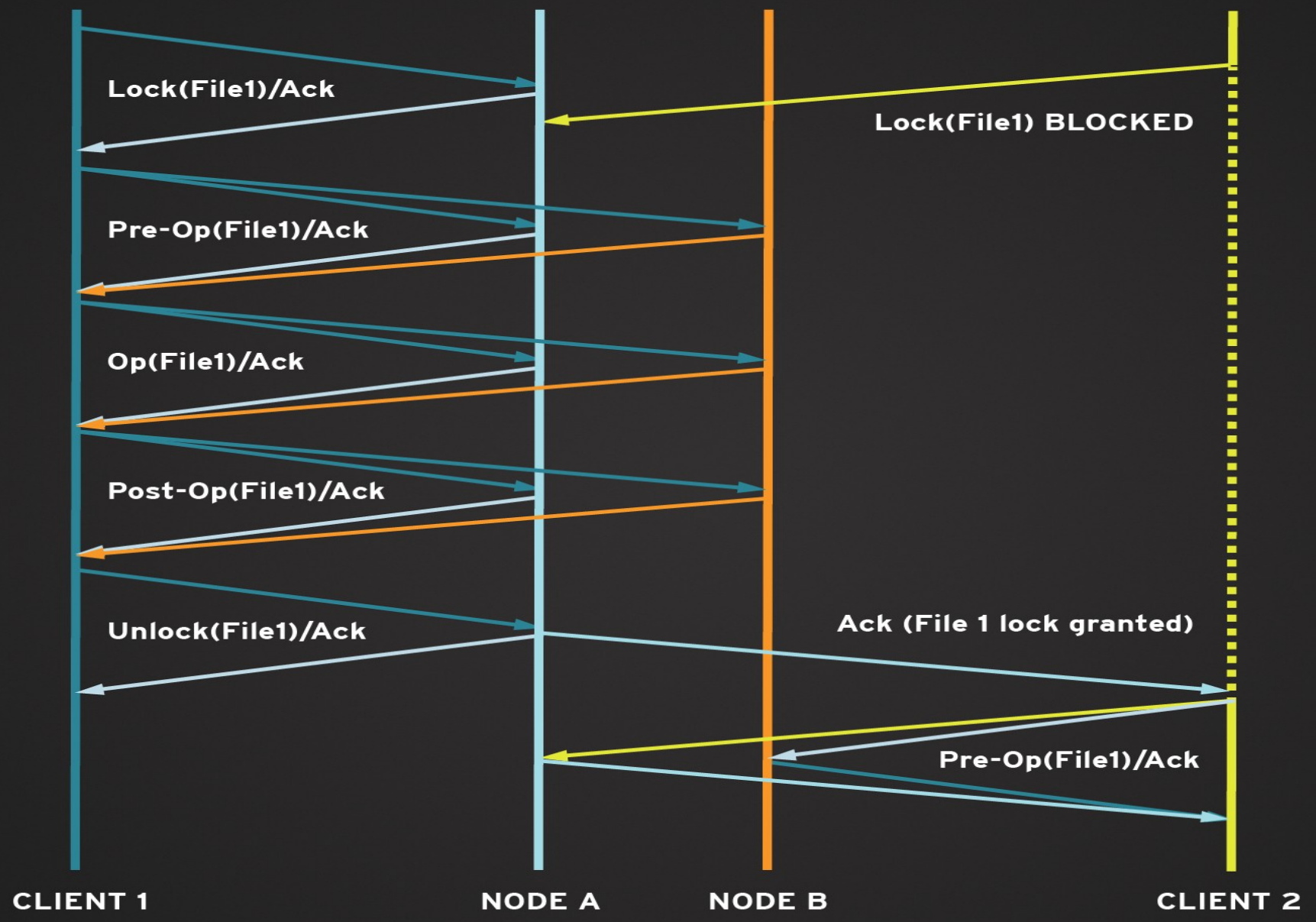


# Data Flow with Native Client

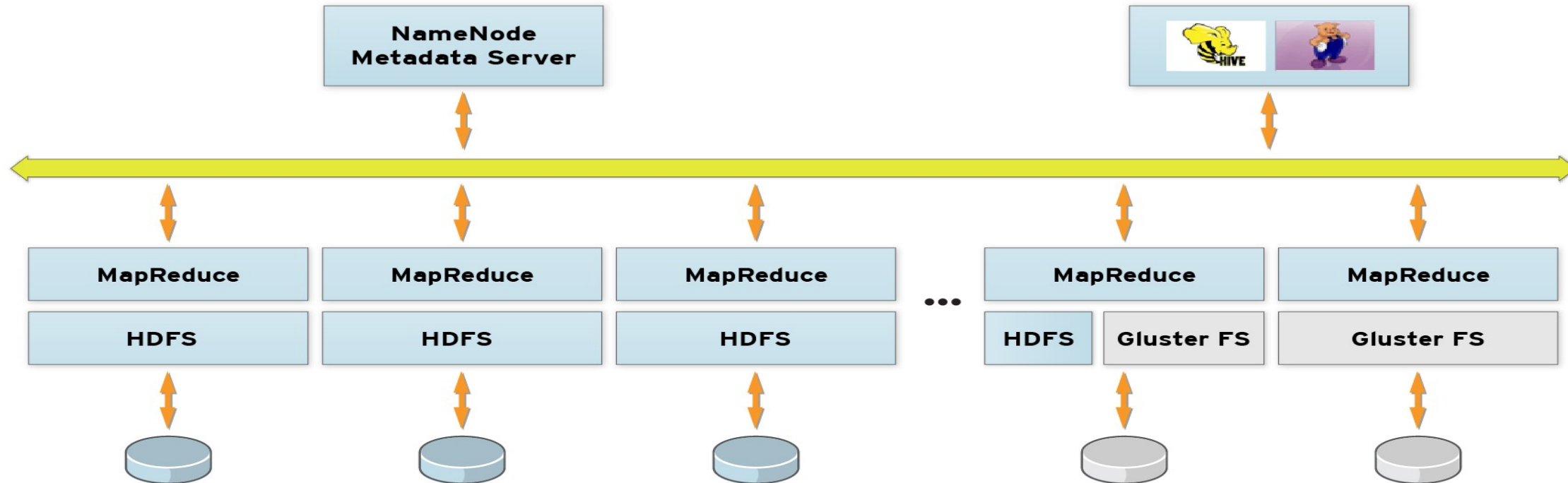




# HOW DOES REPLICATION ACTUALLY WORK?



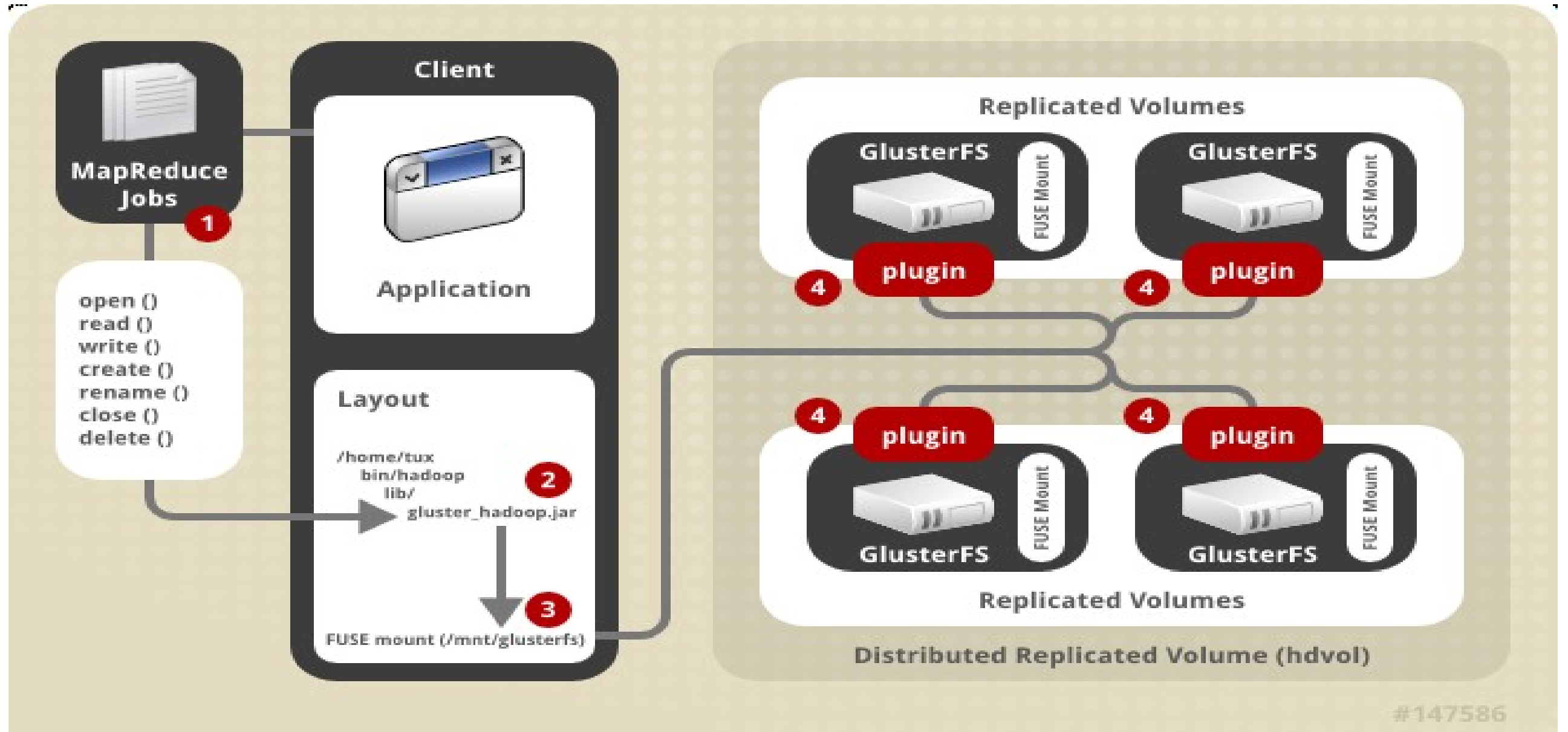
# Seamless Integration for Hadoop Deployments



- GlusterFS can co-exist HDFS
- Does not use the NameNode metadata server

- Built using the Hadoop file system API
- Requires simple configuration file changes
- C Lib GlusterFS client enable GlusterFS direct access
- Provides Java binding for Hadoop compatibility

# Hadoop architecture overview

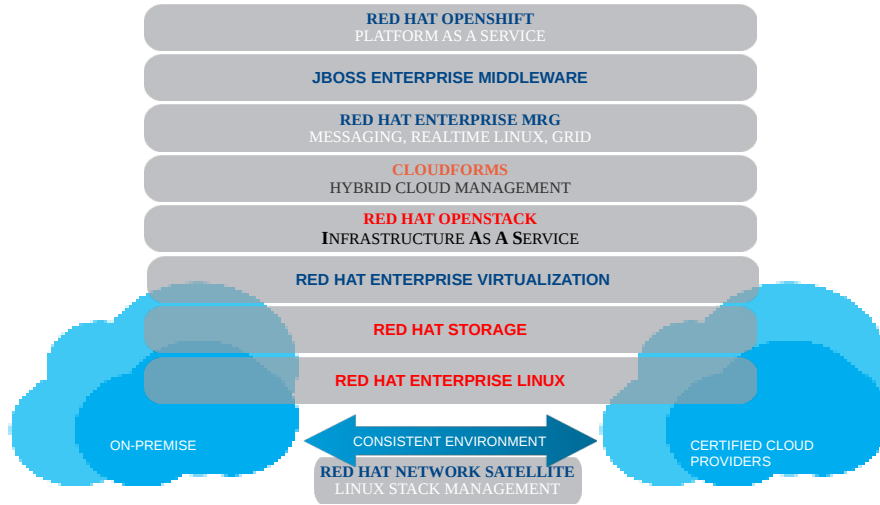




## MANAGING UNSTRUCTURED DATA AT PETABYTE-SCALE

Joachim Schröder  
Manager Solution Architects, DACH  
Email: [joachim.schroeder@redhat.com](mailto:joachim.schroeder@redhat.com)  
November, 14th 2013

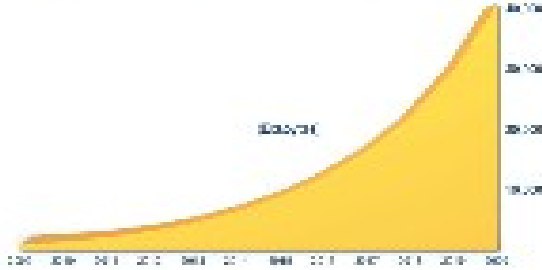
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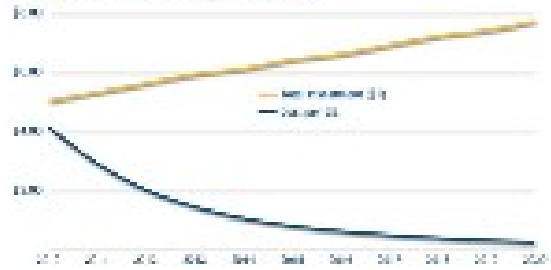
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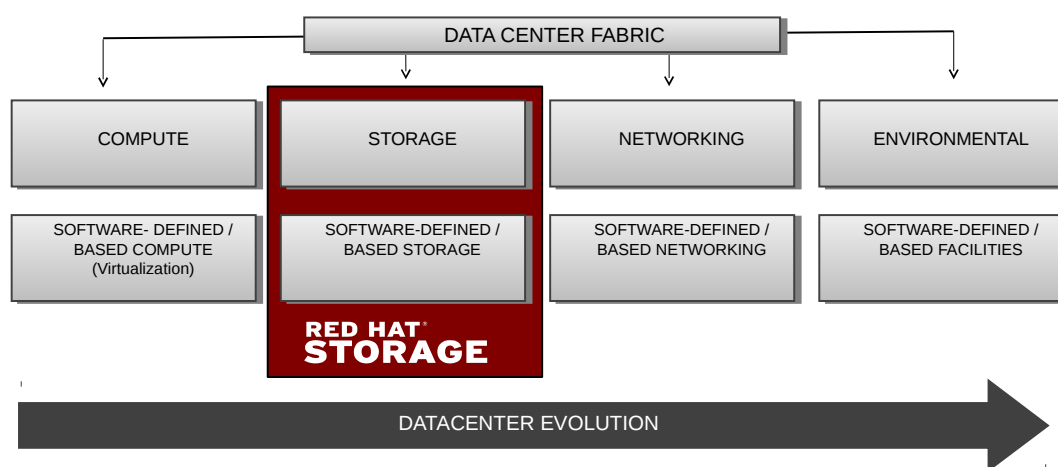
Source: IDC's Digital Universe Study, Dec 2012

The Digital Universe Proceeds: Falling Costs and Rising Investment



Main growth drivers:  
Virtualisation, Cloud, Mobile Computing and Big Data

## CORNERSTONE OF THE NEW SOFTWARE DEFINED DATACENTER



Today's Modern Data Center is increasingly defined by and based on software.

Compute was the first – with virtualization – to begin to abstract data center resources aiding with

## WHAT IS RED HAT STORAGE?

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**Scale-out NAS** (Network Attached Storage)

deployable on

on-premise, virtualized and Cloud environments

based on GlusterFS

running on standard x86 Hardware

# L I D E

requirements for the Big data challenge:

available storage solution that can handle hardware failure.

standards and possibility to be replicated and access over geographical distance.

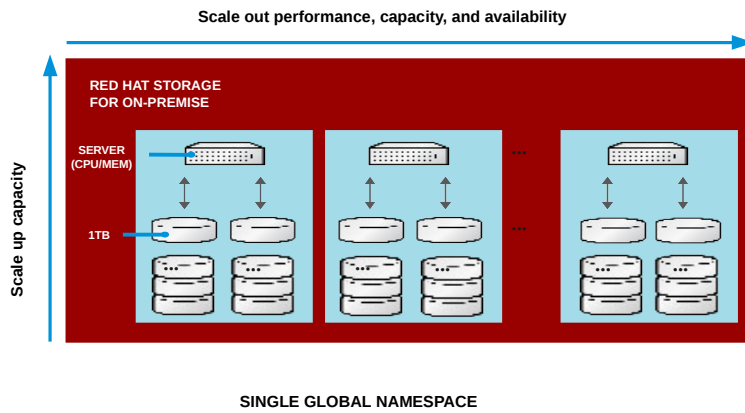
deal if a component would fail to maintain protection level.

agement or minimal manual management would be preferred.

ostic, so run your solution private, public or replicate in between, don't be locked in

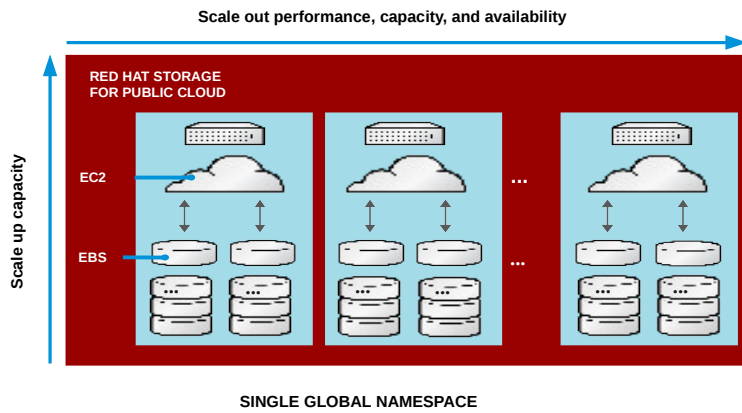
migrations when you lifecycle hardware. Migrations might not be an option if you h

## RED HAT STORAGE DEPLOYMENT ON-PREMISE



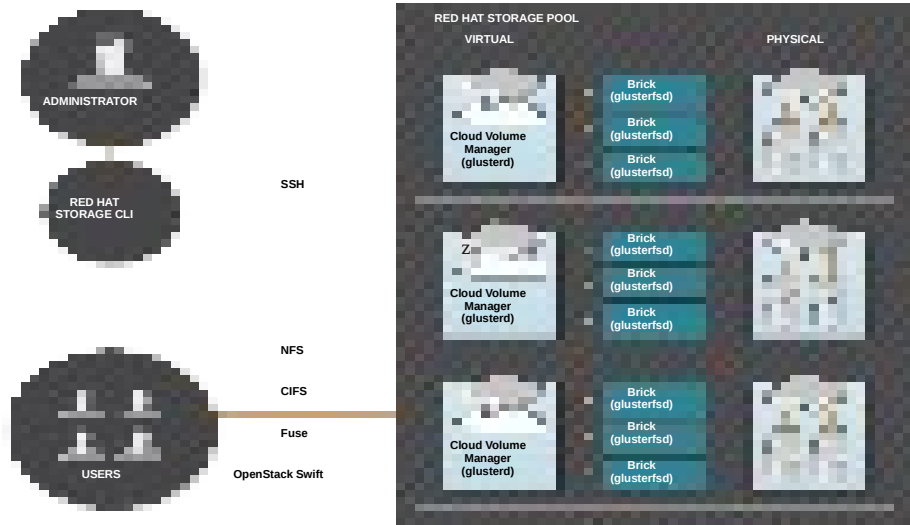
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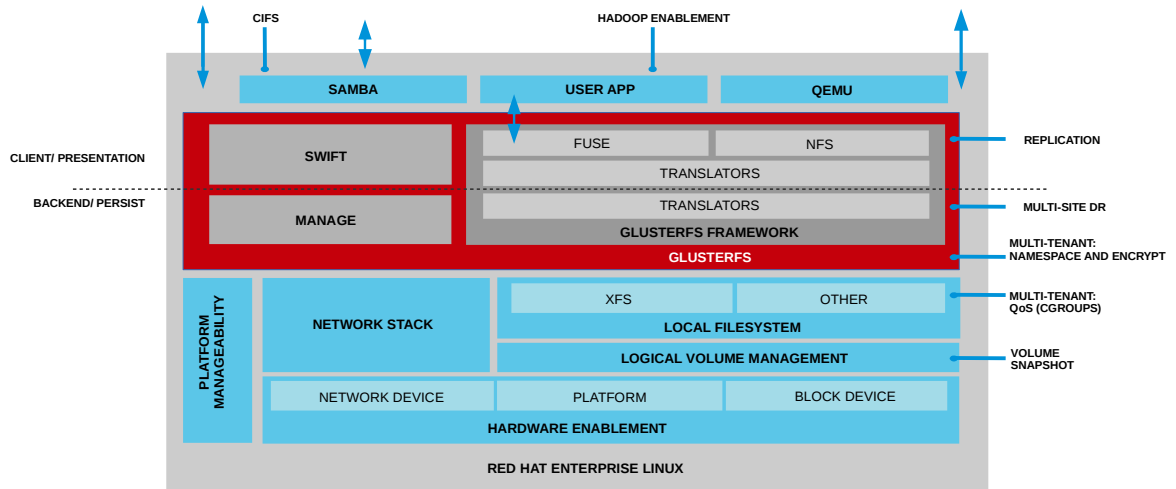
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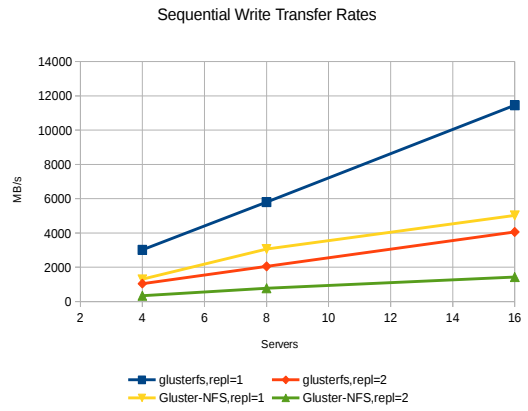
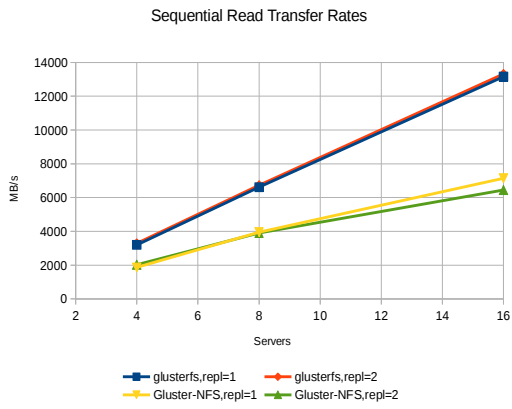




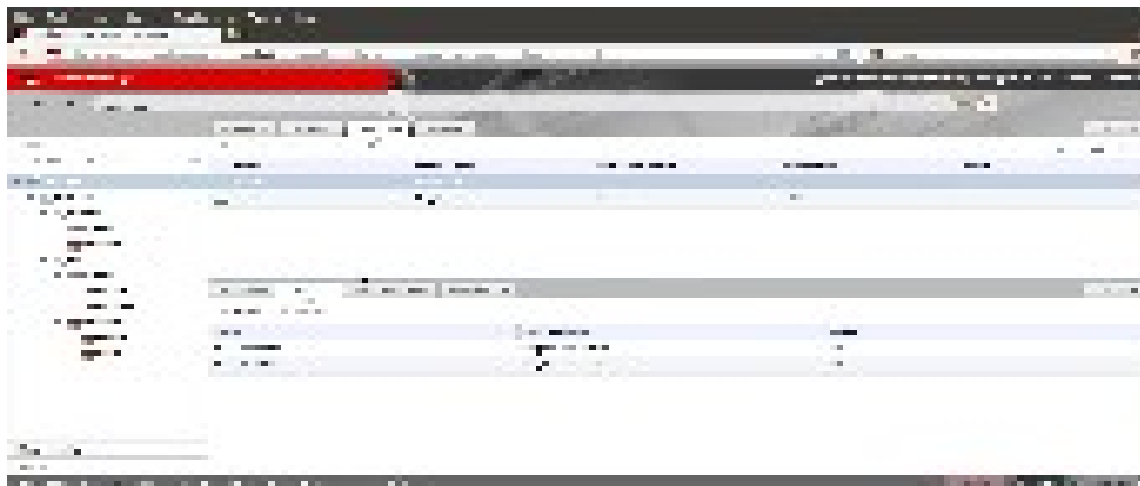
# RED HAT STORAGE TECHNOLOGY STACK



# RED HAT STORAGE SCALABILITY



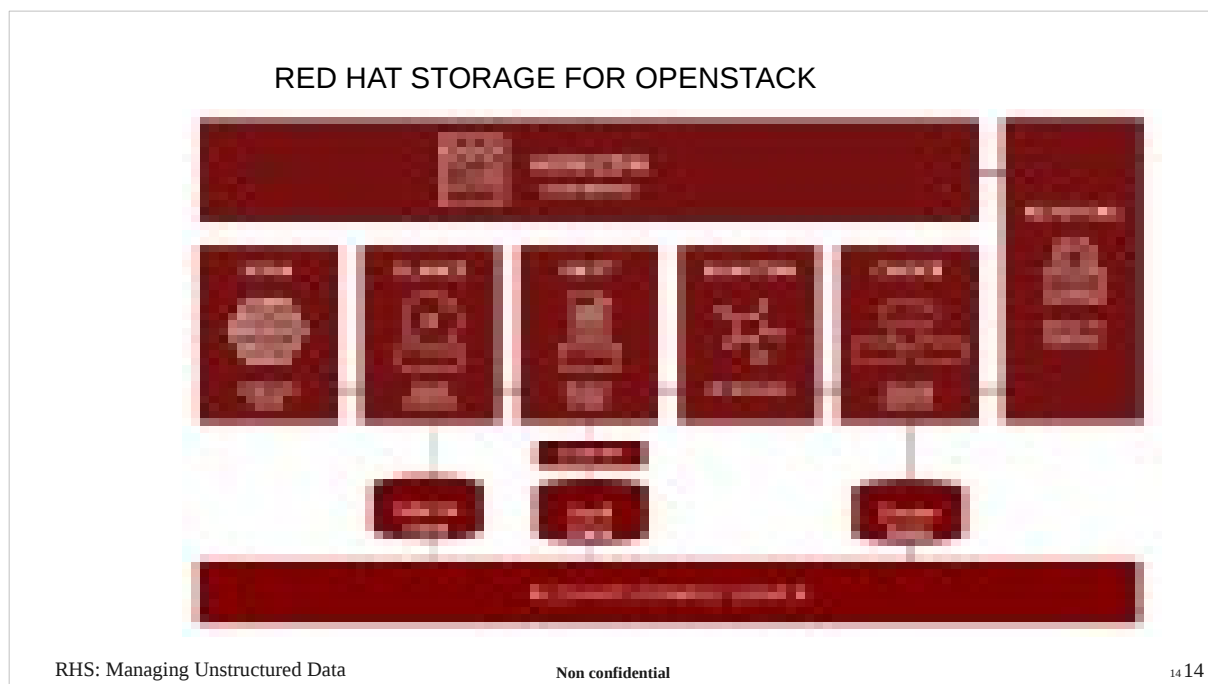
## RHS-C Management Console



## DESIGNED FOR MANAGING UNSTRUCTURED DATA

### SUPPORTING A WIDE RANGE OF ENTERPRISE AND EMERGING WORKLOADS



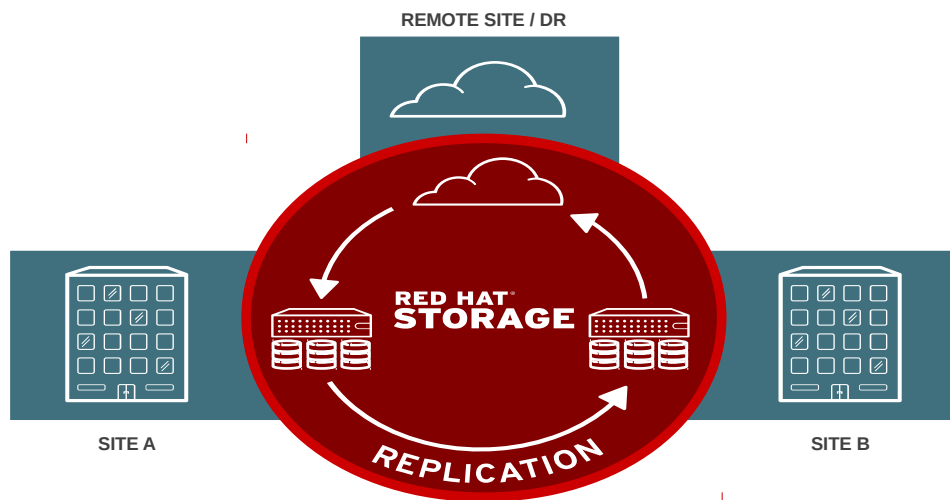


## The different module components:

- Horizon : Management Dashboard
- Nova : Computing resources
- Glance : Image service
- Swift : Object Store
- Quantum : Networking module
- Cinder : Volume service
- Keystone : Authentication

Red Hat Storage fits in as an infrastructural component in below...


ENSURE GLOBAL DATA PROTECTION AND AVAILABILITY  
TRANSPARENTLY DISTRIBUTE DATA GLOBALLY



# Red Hat Storage Allows You to Bring Application

BRING APPLICATIONS CLOSER TO THE DATA  
CONVERGING COMPUTE AND STORAGE

For years traditional storage companies have made the promise of enabling you to take advantage of the compute power locked up in storage appliances to be able to support application workloads.



RED HAT STORAGE

REDUCE LATENCY

PROCESS DATA LOCALLY

REDUCE COSTS

INCREASE AGILITY

STORAGE RESIDENT APPLICATIONS

RHS: Managing Unstructured Data Non confidential 16 16

With Today's new data landscape

## REDUCE LATENCY

Gain increased performance for datasets by eliminating the network hop introduced by traditional architectures

## PROCESS DATA LOCALLY

## REDUCE COSTS



HIGHLY AVAILABLE CLOUD STORAGE FOR AMAZON EC2  
LEVERAGE THE ELASTICITY OF THE CLOUD WITHOUT RE-WRITING YOUR APPLICATIONS



CREATING HIGHLY AVAILABLE, SCALEABLE EBS STORAGE POOLS - ACROSS ZONES  
**Now available as AWS test-drive**

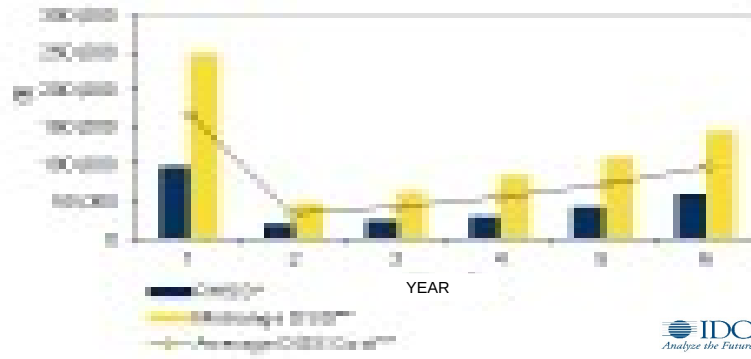
RHS: Managing Unstructured Data

Non confidential

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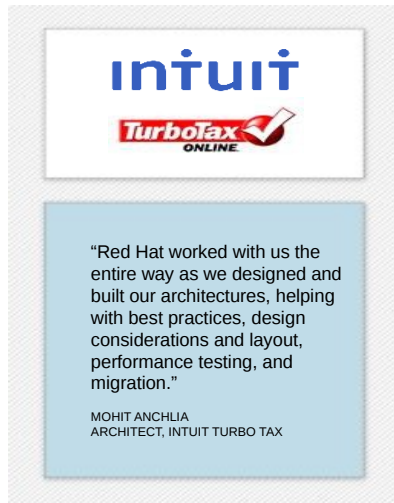
# CUSTOMER USE CASE IntelliTEK

DELIVER COST EFFECTIVE ELASTIC CAPACITY AND PERFORMANCE  
**53% - 78% REDUCTION IN COSTS**



SOURCE: IDC REPORT - THE ECONOMICS OF SOFTWARE BASED STORAGE

## MANAGING SPRAWLING UNSTRUCTURED FINANCIAL DATA



### PROBLEM

- NEEDED A FAST, RELIABLE, AND COST-EFFECTIVE STORAGE SOLUTION TO MEET GROWING SAAS LINE OF BUSINESS
- TAX RETURNS AND OTHER DATA WERE BEING STORED AS BLOBS IN AN EXPENSIVE ORACLE DB

### SOLUTION

- RED HAT STORAGE SERVER 2.0 FOR ON-PREMISE OBJECT STORAGE
- HP DL2000s AND APACHE CASSANDRA

### BENEFITS

- SCALEABLE ON-DEMAND STORAGE FOR UNSTRUCTURED DATA
- COST EFFECTIVE SOLUTION THAT LEVERAGES COMMODITY HARDWARE
- MEET GROWING CAPACITY AND PEAK PERFORMANCE NEEDS
- ACHIEVE MULTI-SITE DISASTER RECOVERY

RHS: Managing Unstructured Data

Non confidential

19 19

### **Presentation Path:**

Pandora serves up all of its music files through Red Hat Storage.

Imagine the scalability challenges Pandora faces. Each store song needs to be transcoded into 12 different file formats, depending on the device (phone, tablet, computer, etc.) accessing it.

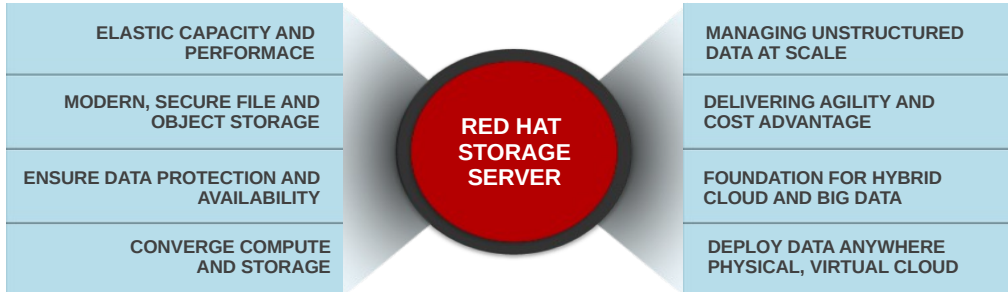
Pandora needs to scale up immediately to accommodate a peak in traffic and, at the same time, accommodate long tail content access as well.

There is a publicly referenceable case study related to this customer. There is no formal write-up available.

# IS THE OPPORTUNITY REAL ?

The screenshot shows a TechTarget article page. At the top, there is a navigation bar with categories like News, Premium Editorial, Multimedia, Storage Topics, Tutorials, Expert Advice, Vendor Content, Blogs, and Storage Decisions Events. A search bar is also present. The main headline is "Red Hat Gluster will transform storage market, IDC analyst predicts" by Carol Silva, published on 08 Aug 2013. Below the headline is an "ESSENTIAL GUIDE" section titled "RED HAT STORAGE SERVER SEEKS TO MIMIC SUCCESS OF ENTERPRISE LINUX". This section includes a sub-headline: "IDC'S NADKARNI PREDICTS MAINSTREAM ACCEPTANCE : READ MORE IN THIS SECTION" and a link: "GlusterFS-based software will drive mainstream acceptance of software-based storage". To the right of this section is a "Latest News" sidebar with five items: EMC Corp. prepares VNX2 launch, Scality CEO: Object-oriented storage needs multiple access methods, Coraid Inc. NAS gets more cache for heavy I/O loads, Riverbed Granite storage box gets Fibre Channel support, and Emerging data storage trends embraced by BNY Mellon IT infrastructure. The article text below the essential guide discusses Red Hat's strategy and quotes Ashish Nadkarni, a research director at IDC.

## DELIVERING THE NEXT GENERATION OF OPEN SOFTWARE-DEFINED STORAGE TODAY



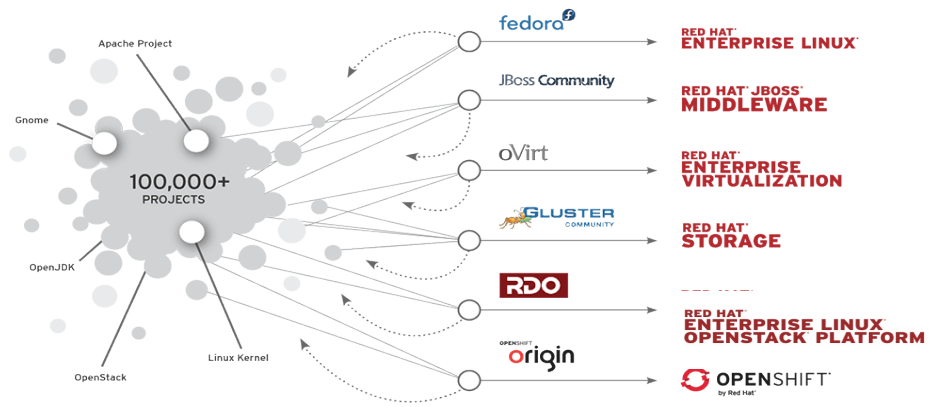
**DESIGNED FOR TODAY'S IT & DATA ECONOMICS**

RED HAT STORAGE – DEVELOPING  
3<sup>rd</sup> PARTY ECO-SYSTEM





## RED HAT LEADS THROUGH OPEN INNOVATION



RHS: Managing Unstructured Data

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23 23

Gerry

# COMMUNITY INNOVATION

## GLUSTER.ORG COMMUNITY FORGE ENHANCEMENTS AND PROJECTS

SNAPSHOTTING

CHANGE DETECTION

COMPRESSION

3-WAY REPLICATION

pNFS AND NFSv4 SUPPORT

FILE VERSIONING

ERASURE CODING

MULTI-MASTER GEO-REPLICATION

The screenshot shows the Gluster Community Forge website. At the top, there is a navigation bar with links for 'Gluster Home', 'Dashboard', 'Register', and 'Login'. Below this is a search bar and a main banner area with a red background containing the text: 'Welcome to the Gluster Community Forge, the home of Open Source software-defined storage development. Read more' and a link to 'Download GlusterFS -> GlusterFS Home'. The main content area is divided into two columns. The left column has two sections: 'Flagship Projects' which lists 'GlusterFS Core' and 'Incubating Projects' which lists 'pfnfsd', 'gfsquota', and 'gfsclone'. The right column has a section titled 'From Planet Gluster' which contains several news items, including 'Gluster Community Day at Portland - July 23' and 'The Summer of Gluster is Here!'.

SMB 3.0 SUPPORT

NDMP SERVER

PUPPET MANAGEMENT MODULE

GTOP - MONITORING

GLUSTER PROFILING

SELINUX SUPPORT

PMUX - LIGHTWEIGHT MAP REDUCE

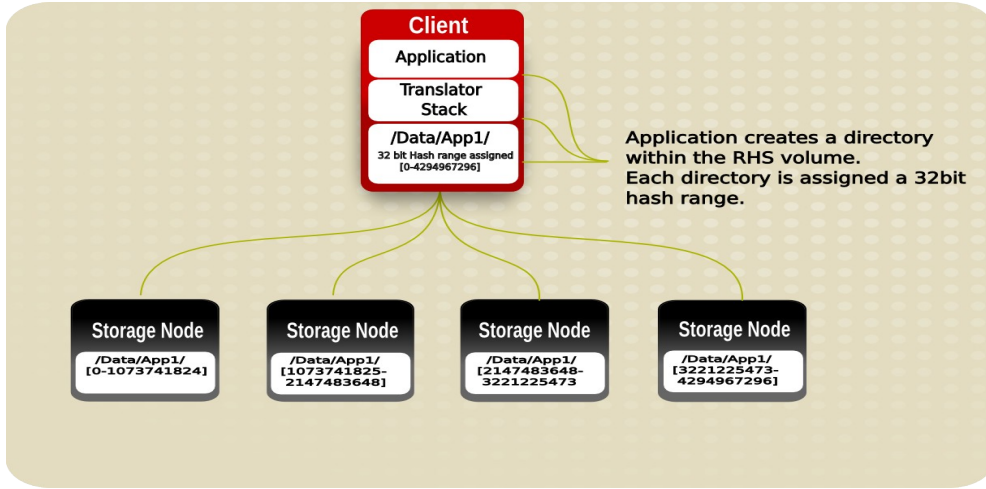
TRANSLATORS EXTENSION FOR PYTHON



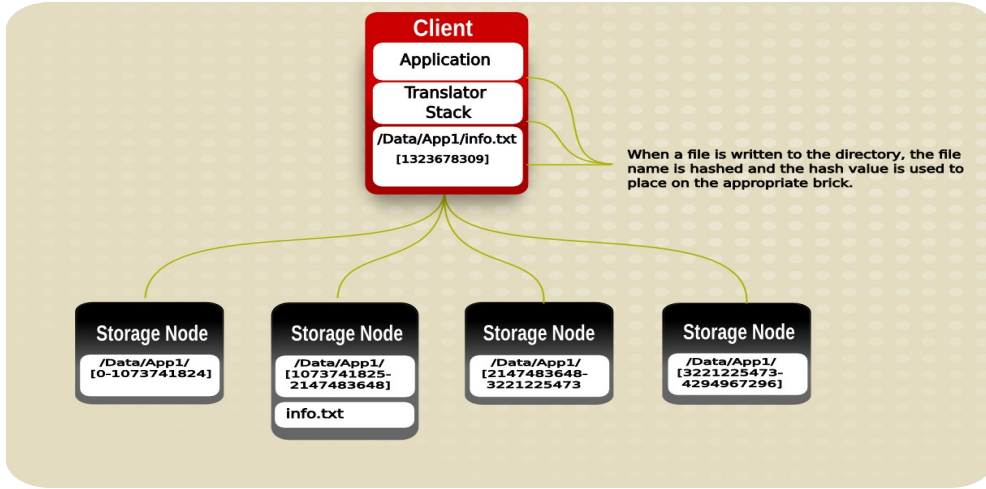
# BACKUP

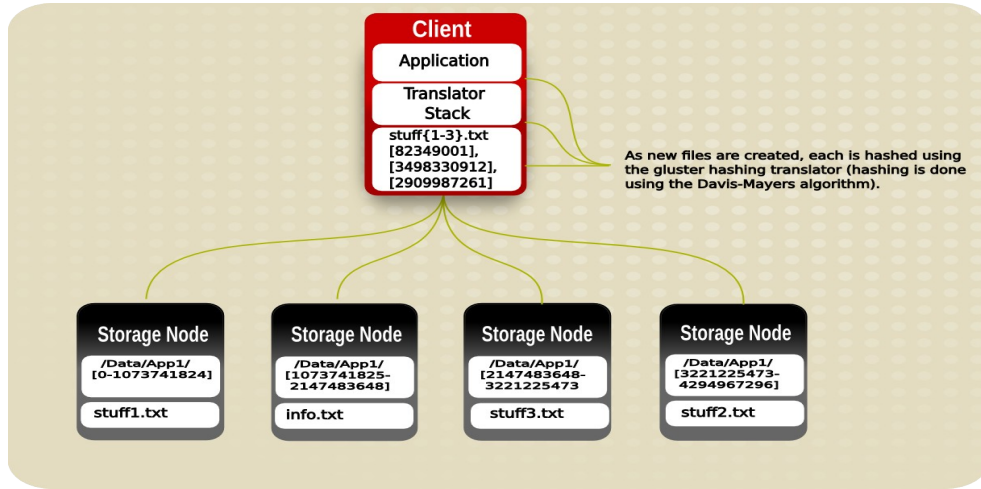
## How Does GlusterFS Work Without Metadata?

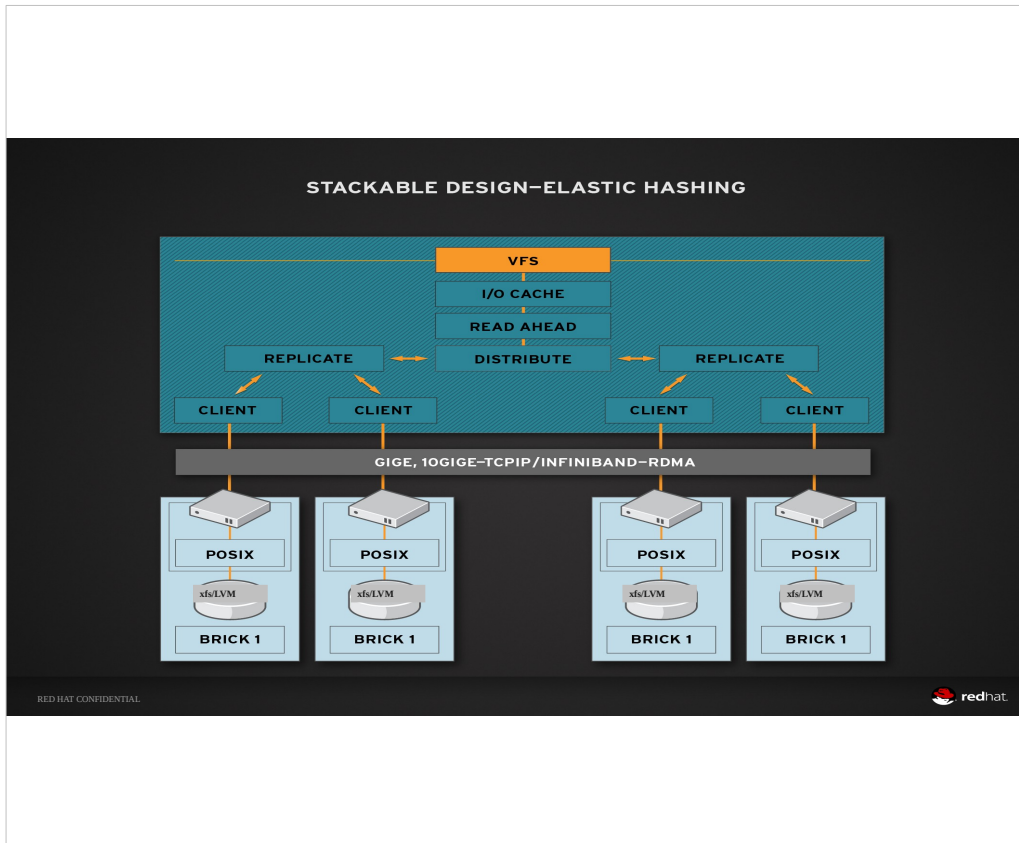
- Files are placed on a brick(s) in the cluster based on a calculation
- All native clients have an algorithm built-in
- All storage nodes have an algorithm built-in
- Files can then be retrieved based on the same calculation
- For non-native clients, the server handles retrieval and placement











## Past decade: Linux + volume x86 servers transformed the *server* market

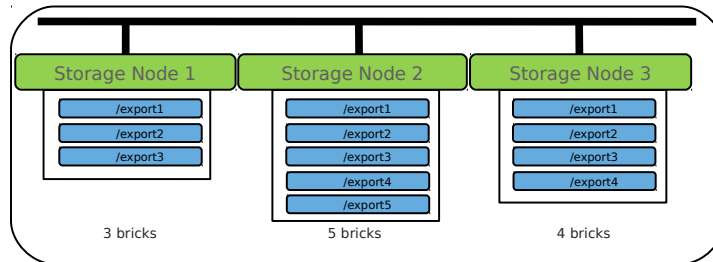
Displaced costly proprietary RISC/UNIX systems  
 Enabled new classes of workloads  
 Showed superior economics

## Current decade: Open-source-based storage + volume x86 servers transform *storage* market

Displacing costly proprietary SAN and NAS systems  
 Cost 1/3 to 1/2 the price of alternative proprietary solutions  
 Enabling new classes of workloads  
 Helping realize the true potential of hybrid clouds

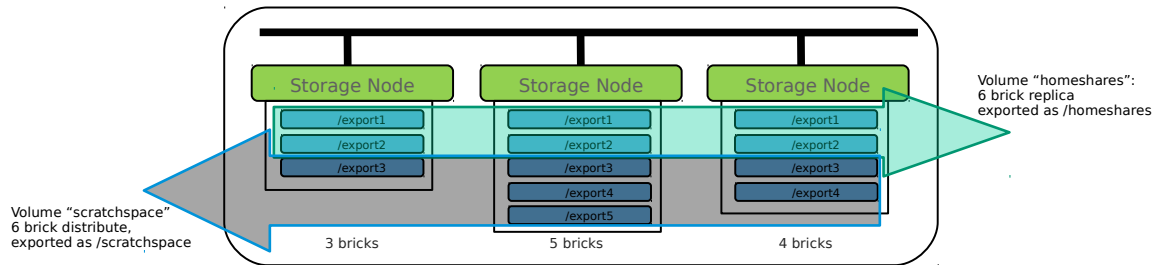
## Bricks

- A brick is the combination of a node and a file system: hostname:/dir
- Each brick inherits limits of the underlying filesystem(xfs)
- RHS operates at the brick level, not at the node level
- Ideally, each brick in a cluster should be the same size

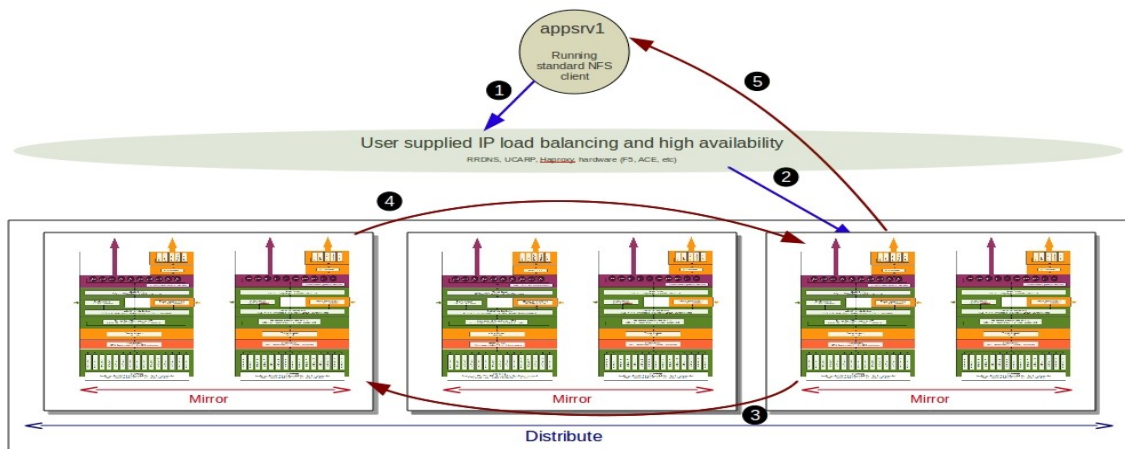


# Volumes

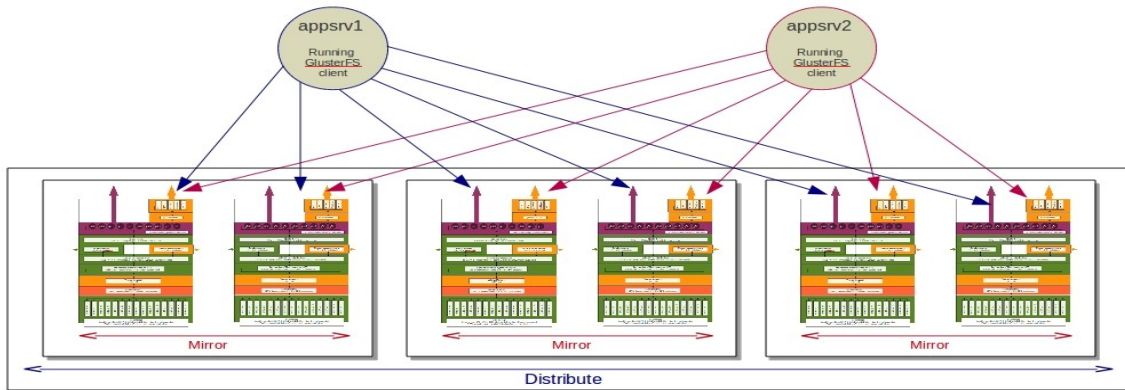
- A volume consists of 1 or more bricks => exported with Gluster.
  - volumes have administrator assigned export names
  - a brick is a member of only one volume
- A namespace can have 1 or more volumes
  - A namespace can consist of replicated and distributed volumes
  - data in different volumes physically exists on different bricks
  - volumes can be mounted on clients using NFS, CIFS and/or GlusterFS clients (native FUSE client)



# Data Flow with NFS/CIFS Client

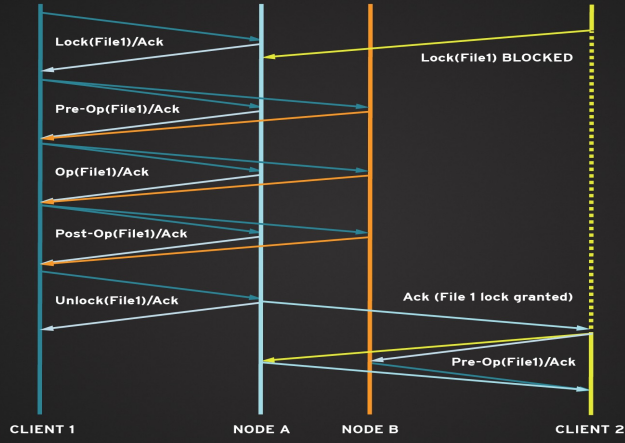


# Data Flow with Native Client

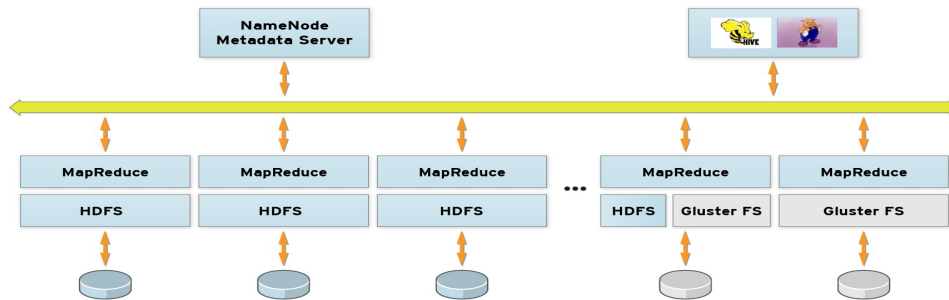




### HOW DOES REPLICATION ACTUALLY WORK?



## Seamless Integration for Hadoop Deployments



- GlusterFS can co-exist HDFS
- Does not use the NameNode metadata server
- Built using the Hadoop file system API
- Requires simple configuration file changes
- C Lib GlusterFS client enable GlusterFS direct access
- Provides Java binding for Hadoop compatibility

# Hadoop architecture overview

