# Storage Fusion Deep Dive / Day2 Operations

Storage Scale German User Meeting 2023 Sindelfingen, Germany – March 22-23, 2023

Daniel Danner Lead Architect for Storage Fusion (D/A/CH) <u>daniel.danner@ibm.com</u>



# Agenda

- Fusion Overview
- Fusion Metro DR
- Fusion Day 2 Operations

### What about below the red line?

Many choices to run OpenShift in the cloud as a service or create your own environment.

But how easy to run OpenShift in your data center? On the edge?

Can you connect the them together?



## Introducing IBM Storage Fusion

### We've designed Storage Fusion to address the data management challenges

being faced as customers transitions to Containers and OpenShift



Infrastructure

Cloud

Azure

Google Cloud

Edge



Systems

IBM Storage Fusion with two deployment options: OpenShift appliance or stand-alone software

OpenShift Appliance + data services platform



IBM Storage Fusion HCI OpenShift data services platform software

Red Hat OpenShift Bare Metal x86

> IBM Storage Fusion







IBM Storage Fusion

# IBM Storage Fusion Architecture

**vm**ware<sup>\*</sup>



Compute, Storage and Network

Storage Fusion HCI



IBM Storage Fusion HCI System

An Engineered System for OpenShift

Integrated | Resilient | Built for OpenShift

"Bare-metal OpenShift in a Box"



# What is it?

# An engineered compute system with OpenShift installed

- Bare-metal x86 servers
- Ethernet switches
  - OpenShift application network (25 GbE)
  - Dedicated storage network (100 GbE)
- Hyper-converged storage architecture
- Engineered for performance and resiliency
- Supported by IBM (SPOC)

### "Bare-metal OpenShift in a Box"



# Why?

# Time to Value

You could spend six months designing an architecture and six months proving it, or

*Eliminate the guess work and go with a proven solution.* 

Deploy a high resiliency OpenShift cluster on bare metal in less than a day

Accelerate getting OpenShift clusters into production



# Why?

# **Reduce Risk**

Eliminate risk of poor cluster design and missed performance objectives

Engineered for resiliency: ensure continuous operation of business-critical applications

Supported by IBM



# Why?

# **Reduce Total Cost of Ownership**

### No need to design/prove/maintain

- a hardware architecture
- a resilient network
- a resilient and high-performance storage layer
- an OpenShift deployment model

### Eliminate the virtualization tax

Performance, cost, and operational overhead

### Consolidate skills to a common platform

- Build once, run anywhere
- Innovate anywhere, with anyone's technology
- Consistent everywhere

Application resiliency services from IBM Storage Fusion								
Container orchestration from Red Hat								
Ŭ,	aws		0	()	Ŭ,			
IBM public cloud	AWS	Azure	Google Cloud	Edge	Private	Systems		

# Fusion HCI System rack-up

Base configuration (smallest thing clients can order today)

- 42U rack, pre-loomed networking, 6 PDUs
- 2x Ethernet high-speed switches (100GbS)
- 2x Ethernet management switches
- 6x Storage/Compute servers with 2 NVMe drives/server
  - Server in RU7 is the provisioner node, connected to the KVM
  - Servers in RU2, RU3, and RU4 become the OpenShift control plane

### Scale out options:

- 32c or 64c multithread nodes
- Storage rich and compute only nodes
- Memory options 8 GB to 32 GB RAM per physical core
- Up to 20 nodes per rack, in-field scalable
- GPU servers, each with 3x NVIDIA A100 GPUs
- Increased storage by adding pairs of drives to storage/compute servers
  - 7.68TB NVMe PCIe Gen4 drives/server to a max of 10 drives/server
- AFM (Active File Manager) NFS/S3 gateway nodes

42	
41	3U Filler
40	
39	
38	3U Filler
37	
36	1U PDU (horizontally mounted)
35	1U PDU (horizontally mounted)
34	211 Filler
33	
32	Storage/Compute Server
31	Storage/Compute Server
30	Storage/Compute Server
29	Storage/Compute Server
28	GPU Server with 3x GPU PCIe Gen 4 adapter cards
27	
26	GPU Server with 3x GPU PCIe Gen 4 adapter cards
25	
24	AFM Node
23	AFM Node
22	KVM Service Console
21	32-port 100 GbE Ethernet Switch
20	32-port 100 GbE Ethernet Switch
19	48-port 1 GbE Management Ethernet Switch
18	48-port 1 GbE Management Ethernet Switch
17	Storage/Compute Server
16	Storage/Compute Server
15	Storage/Compute Server
14	Storage/Compute Server
13	Storage/Compute Server
12	Storage/Compute Server
11	Storage/Compute Server
10	Storage/Compute Server
9	Storage/Compute Server
8	Storage/Compute Server
7	Storage/Compute Server
6	Storage/Compute Server
5	Storage/Compute Server
4	Storage/Compute Server
3	Storage/Compute Server
2	Storage/Compute Server
1	Reserve 1U Space at Bottom
	Required
	Optional

### Fusion HCI System Scale compute and storage

#### Scale compute

6 nodes to 20 nodes



### Worker node options

# Fusion HCI System Value of storage architecture

### Scale-out parallel file system

- Enormous scalability with software-based declustered RAID protection
- Very high performance no additional RAID hardware
- Performance scales as you add nodes

### Durable and robust storage

- Distributes data across nodes and drives for higher durability without the cost of replication
- End to end checksum identifies and corrects errors introduced by network or media
- Withstands multiple failures; Rapid recovery and rebuild

# High storage efficiency

- 66% efficient with default 4+2p erasure coding
- 75% efficient with 8+3p optional erasure coding
- Lower cost than 33% efficient 3-way replication



### Fusion HCI System High performance for demanding workloads

	Provisioning modes		Persistence		File	File	AFM S3	AEM NES	Scale out	Frasure	
	Dynamic	Static	Zone <sup>1</sup>	Multi- zone <sup>2</sup>	RWX	RWO <sup>3</sup>	Caching	Caching	parallel file system <sup>4</sup>	coding	
Fusion HCI	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	
NFS	Х	$\checkmark$	Х	Х	$\checkmark$	Х	Х	Х	Х	Х	
vSphere Volume	$\checkmark$	$\checkmark$	Х	Х	$\checkmark$	$\checkmark$	(3rd party)	Х	Х	Х	

1) Fusion Metro DR synchronous data replication

2) Fusion Regional DR asynchronous data replication (roadmap 1H23)

3) Ideal for Cloud Paks and other applications that specify a need for block storage

4) High throughput, low latency performance for modern AI/ML and analytics workloads

IBM Storage Fusion HCI System

# **Application High Availability**

# IBM Storage Fusion & **Red Hat Advanced Cluster Management**



### **RH ACM**

- OCP management
- Application management
- Policy management

**IBM Storage Fusion** 

### **Scenarios**

- Monitor Storage Fusion systems
- Change configurations
- Upgrade Storage Fusion systems
- Deploy applications across all Storage Fusion systems
- Policy Management



**IBM Storage Fusion** 

**IBM Storage Fusion** 

# IBM Storage Fusion & Red Hat Advanced Cluster Management



Please keep in mind!

### RHACM is a **Deployment and Configuration Management Tool!**

It does not take care of mirroring or moving persistent data (PVCs) to another Openshift Cluster!

# **Ensure Application Availability**

Enable I&O teams to implement easy to use HA / DR services

# Metro DR, Multi-Availability Zone

- Synchronous data replication
- Distance restriction Regions must be connected by high-bandwidth, low latency link
- "tie-breaker" application manages fail-over





# Application High Availability

### **Metro DR replication**

- Pair Fusion HCI racks in a Metropolitan area
- Replicate data synchronously between the two racks
- RPO = 0, RTO is variable

## **Regional DR replication**\*

- Pair Fusion HCI racks world-wide
- Replicate data asynchronously between the two racks
- RPO = variable

# Application replication is more than just replicating storage







# Storage Fusion HCI System

## Enable Metro-DR per Application

Red Hat OpenShift Container Platform		
🗱 Administrator 🛛 👻	You are logged in as a temporary administrative user. Update the <u>cluster OAuth configuration</u> to	allo
Home >	PersistentVolume > PersistentVolume details PV pvc-807b4b01-100d-4884-a2c8-1d81baf825db @ Bound	
Operators >		
Workloads >	Details YAML	
Networking >	Alt + F1         Accessibility           78         version: '2'           78         version: '2'	/ help
Storage 🗸 🗸	79     V0184CKENDES: 1.DM-SpectPUM-Scale-ts-gpts01-10042044300412272230       80     accessModes:       81	
PersistentVolumes	82 claimRef: 83 kind: PersistentVolumeClaim	
PersistentVolumeClaims	84   namespace: as-postgres     85   name: postgres-pvc	
StorageClasses	86 uid: 807b4b01-100d-4884-a2c8-1d81baf825db 87 apiVersion: v1	
VolumeSnapshots	<pre>88 resourceVersion: '1175114' 89 persistentVolumeReclaimPolicy: Delete</pre>	
VolumeSnapshotClasses	90       storageClassName: spectrum-tusion         91       volumeMode: Filesystem	
VolumeSnapshotContents	92 status: 93 phase: Bound 94	
Builds >	Save Reload Cancel	
Monitoring >		

IBM Storage Fusion will:

- A) Create a second, sync copy of all storage class content
- B) leverage Ramen DR to replicate the PV metadata

When the Application is deployed on ClusterB (including the PVC), Openshift will verify if an existing PV has a claimRef to the PVC. Only if <u>not</u> a new PV will be generated

-> ensure replication is active prior to deploying the application on Cluster B

# Storage Fusion HCI System Enable Metro-DR per Application

#### × IBM Spectrum Fusion Quick start Applications Events Applications are automatically generated based on existing OpenShift projects. Applications Backup policies Backup status: All $\checkmark$ Q Search.. \$ Disaster recovery **Cloud Satellite** Capacity (GiB) Last backup on Name Used (GiB) Disaster recovery **Backup status** Infrastructure 200 1000 Disabled Backed up 6/1/2020 9:30 AM grafana Services Details Settings 451 1000 Disabled No policy instana Assign policy 800 2000 Disabled Backed up netreo Restore Enable disaster recovery 122 1000 Disabled Backed up prometheus Gravievev Z. HUTT 891 1000 Disabled Backed up 6/31/2020 7:30 AM splunk 342 splunki 5000 Disabled Backed up 5/1/2020 12:20 PM 100 2500 Disabled ÷ turbonomic No policy trademark 150 1000 Disabled No policy 445 umbrella 1500 Disabled Failed 6/1/2020 9:40 PM zoloo 268 2000 Disabled Backed up 6/15/2020 8:00 AM Items per page: 10 🗸 1-10 of 58 items 1 ∨ of 6 pages 4 .

# Storage Fusion HCI System

### The Metro-DR configuration is part of the Storage Fusion setup



# Storage Fusion HCI System

### Automate install of the tie-breaker



	IBM Spectrum Fusion	isf-rack_abc	0	¢	٩	
Quic Ever Appl	k start hts lications	Disaster recovery Synchronous replication between two sites.				
Back	kup policies	Synchronizing data between sites			~	
Disa Clow Infra Serv Sett	da satellite d satellite ices ings	Terrester Terrester ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓	. settin bout the frtual m	g up the require achine.	©	

# Simplified monitoring of the MetroDR configuration

# Regional disaster recovery (ROADMAP 2023)



**IBM Storage Fusion** 

Storage Fusion HCI System Day 2 Operations

# What are Day 2 operations?

Imagine you're moving into a house.



Day 1 operations are moving into the house (installation / deployment).

Day 2 operations are the "housekeeping" stage of a systems life cycle. The care and feeding of the system, maintaining the overall stability and health in production.

- Monitoring
- Troubleshooting
- Updating
- Increasing capacity
- Backups and Restores

# IBM Storage Fusion HCI Day2 Operations

(Temp)



Compute, Storage and Network

# Fusion HCI System Single Pane of Glas UI

Integrated lifecycle management

- Red Hat OpenShift Operators are used for managing the hardware of Fusion HCI System
- The inventory of all compute nodes and Ethernet switches is presented using an intuitive GUI
- The status of the hardware is shown along with menus of available actions
- Regular updates of the firmware of all components are provided
- Rolling updates



### Fusion HCI System Two ways to manage, and it's the same everywhere!

### Management UI

- Guided experience
- Simplified workflows



### "As code" via custom resources

- Kubernetes native APIs
- Check configuration policies into git for easy deployment into multiple clusters (GitOps)

```
apiVersion: data-protection.isf.ibm.com/v1alpha1
kind: PolicyAssignment
metadata:
    name: wordpress-aws-daily
    namespace: ibm-spectrum-fusion-ns
spec:
    application: wordpress
    backupPolicy: aws-daily
    runNow: true
```

Enable I&O administrators to define and deliver data services that can be consumed by application teams on demand

### Storage Fusion Provides a UI and As Code to easily *define backup locations*

Adding a backup location



As code apiVersion: data-protection.isf.ibm.com/v1alpha1 kind: BackupStorageLocation metadata: name: aws-bucket namespace: ibm-spectrum-fusion-ns spec: type: aws credentialName: "aws-credentials" params: bucket: backup-bucket region: us-east-1

and a second s		
aws-bucket		
		-
Object storage type		
Select the type of object storage backup object storage. Learn more	o location. Fusion supports many types of	
IBM Cloud IBM * Object Storage	Azure Microsoft * Object Storage	
AWS Amazon * Object Storage	S3 Compliant Any * Object Storage	
Credentials Add your login credentials to connect Fi Learn more	usion to your backup location.	
Credentials Add your login credentials to connect Fi Learn more Endpoint *	usion to your backup location. Bucket *	
Credentials Add your login credentials to connect Fi Learn more Endpoint * https://endpoint-address Pacials *	usion to your backup location. Bucket * backup-bucket	
Credentials Add your login credentials to connect Fi Learn more Endpoint * https://endpoint-address Region * us-east-1	usion to your backup location. Bucket * backup-bucket	
Credentials Add your login credentials to connect Fi Learn more Endpoint * https://endpoint-address Region * us-east-1 Access key *	Bucket * backup-bucket Secret key *	
Credentials Add your login credentials to connect Fi Learn more Endpoint *  https://endpoint-address Region * us-east-1 Access key * accesskey	Bucket * backup-bucket Secret key *	
Credentials Add your login credentials to connect Fi Learn more Endpoint * https://endpoint-address Region * us-east-1 Access key * accesskey Encryption key	usion to your backup location. Bucket * backup-bucket Secret key *	

# Storage Fusion Provides a UI and As Code to easily *assign backup policies*



Creating a policy	Set the frequency in which the associated backup jobs must run.					
oroating a poney	Hourly	Default time 12:00 AM ~ America/I ~				
	Daily 🗢					
As code	Weekly					
	Monthly					
	Custom					
apiversion: data-protection.ist.ibm.com/vialphai kind: BackupPolicy metadata:	Backup Locations Select a location for storing th	e backups this policy will create.				
<pre>name: aws-daily namespace: ibm-spectrum-fusion-ns</pre>	In place snapshot Snapshots are stored in place an not transfered to object storage.	Object storage Object storage backup locations protect your applications in the event of a cluster failure.				
spec:						
backupStorageLocation: aws-bucket	Q Search					
provider: isf-ibmspp retention:	aws-bus aws	cket				
unit: day schedule:	Retention Define how long these backup	copies will exist in the backup storage location.				
cron: 0 12 * * *	Retention					
timezone: America/Los_Angeles	7 days ~					

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## Storage Fusion Provides a UI and As Code to easily *restore an application*

# Restoring an application



As code apiVersion: data-protection.isf.ibm.com/v1alpha1 kind: Restore metadata: name: wordpress-restore-2022-03-01 namespace: ibm-spectrum-fusion-ns spec: backup: wordpress-backup-2022-03-01

#### Restore grafana

Restore missing resources and PVCs in this application by selecting the restore type and identifying the resources to restore from a backup. Learn more

ø

#### Restore type

Select the type of restore to perform on this application.

Restore to a different project Restoring a backup to a new or a different existing OpenShift project. Restore to same project

Restore this application using a backup to the same OpenShift project. ×

#### **OpenShift Project**

Select an existing OpenShift project or create a new one to test this application restore. Selecting an existing project will overwrite all data currently residing in that project.

Select restore test location

Create a new project
 Project name

Name

O Use an existing project

Cancel

# Backup Status

### Validate the current Configuration and Status of your Backups

#### \$ oc get backuppolicies.data-protection.isf.ibm.com

NAME	PROVIDER	SCHEDULE	RETENTION	RETENTIONUNI
daily-snap-10d	isf-ibmspp	00 1 * * *	10	days
hourly20days	isf-ibmspp	35 * * * *	20	days
weekly-full-10d	isf-ibmspp	00 0 * * 0	10	days

#### \$ oc get backupstoragelocations.data-protection.isf.ibm.com

NAME	PROVIDER	PHASE
cos-ibmcloud-hs	isf-ibmspp	on-line
cos-onprem-zone4	isf-ibmspp	on-line
in-place-snapshot	isf-ibmspp	on-line

#### \$ oc get fbackup

NAME			PROVIDER	PHASE	STARTTIME
ENDTIME	EXPIRATION	OBJECTSNUM	OBJECTSPROCESSED		
ddannerdemo-hourly20 2022-07-22T19:38:07Z	days-ddannerdemo-1658 2022-08-11T19:35:0	5185701 0Z 2	isf-ibmspp	Completed	2022-07-22T19:35:00Z
ddannerdemo-hourly20 2022-07-22T20:38:077	days-ddannerdemo-1658 2022-08-11T20:35:0	5221701 07 2	isf-ibmspp	Completed	2022-07-22T20:35:00Z

# Storage Fusion OpenShift Integration Display all Events from the UI on OpenShift

\$ oc get events -n ibm-Storage-fusion-ns

LAST SEEN TYPE REASON OBJECT 10d Warning ISFEventManager deployment/eventmanager address: mgmt1=78ac99a:78AC95A popt: swp47 = 507 MESSAGE

BMYNW0055 - CumulusLinkDOWN, hardware

# Network Configuration and Status

Access the current Network configuration and Status form the OCP CLI

#### \$ oc get switches

NAME	AGE
hspeed1-78ac99a	35d
hspeed2-78ac99a	35d
mgmt1-78ac99a	35d
mgmt2-78ac99a	35d

#### \$ oc get switches hspeed1-78ac99a -o yaml

#### •••

#### spec:

#### cutomerPorts:

- "31"
- "32"

#### .... cutomerPortStatus:

- inputPkt: "387925128" outputPkt: "126215691" portNumber: "31" portState: UP speed: 100G
- inputPkt: "0" outputPkt: "0" portNumber: "32" portState: ADMDN speed: N/A

#### status:

availableFirmwareVersion: 4.3.0
currentFirmwareVersion: 4.3.0

#### temperatureStatus:

state: OK

#### anStatus:

state: OK

- \$ oc get vlans rack-vlans -o yaml
  torVlanSpec:
  - Description: Internal Storage VLAN multipleLinks: "no" vlanId: "3201" vlanName: Internal Storage
    - vlanType: Internal Storage VLAN
  - Description: Internal Management VLAN multipleLinks: "no" vlanId: "4091"
    - vlanName: Internal Management
  - vlanType: Internal Management VLAN
  - Description: Data VLAN on TOR switch multipleLinks: "no" vlanId: "40" vlanName: vlan40

# Firmware Package Details

### See the Firmwaredetails of each Component in great detail

\$ oc get computefirmwares firmware-compute-1 -o yaml

#### status:

availableFirmwareVersion: isf-2.1.0
currentFirmwareVersion: isf-2.1.0

#### firmwareInfos:

- description: XCC Firmware name: BMC (Primary) version: D80T16J-3.01
- description: UEFI Firmware/BIOS name: UEFI version: D8E116E-2.01
- description: NVMe DiskDrive Firmware name: NVMeDiskDriveFirmware version: CQ36
- description: DETA Power Supply Firmware name: DETA Firmware version: "4.51"

 description: Mellanox Firmware Bundle name: ThinkSystem Mellanox ConnectX-6 HDR100/100GbE QSFP56 2-port PCIe VPI Adapter (Mellanox Firmware Bundle) version: 20.28.2006

#### description: Mellanox uEFI driver name: ThinkSystem Mellanox ConnectX-4 Lx 10/25GbE SFP28 2-port PCIe Ethernet Adapter (Mellanox uEFI driver) version: 14.21.17

 description: Mellanox Base Firmware name: ThinkSystem Mellanox ConnectX-4 Lx 10/25GbE SFP28
 2-port PCIe Ethernet Adapter (Mellanox Base Firmware) version: 14.28.2006
 version: 14.21.17

```
• • •
```

ocpNodeName: compute-1.fusion-hci.lab.escc.de.ibm.com systemProdName: 7D2XCT01WW systemSerialNumber: xxxxxxxx updateRequired: false

# **Update and Software Status**

Access the current Software Versions and see if a update is needed from the OCP CLI

#### \$ oc get updatemanagers

NAMEAVAILABLEUPGRADINGERRORversionTrueFalseFalse

#### \$ oc get updatemanagers -o yaml

#### status:

componentsState:
 fusionSwState:
 availableVersion: 2.2.1
 currentVersion: 2.2.1

#### nodeState:

#### nodes:

 availableFirmwareVersion: isf-2.1.0 currentFirmwareVersion: isf-2.1.0 nodeName: firmware-compute-2 systemSerialNumber: J101LNY2 updateAvailable: "no"

#### openshiftState

currentVersion: 4.8.19
updateAvailable: "no"

#### openshiftState:

currentVersion: 4.8.19
updateAvailable: "no"

#### scaleState:

availableUpgradeVersion: 5.1.3.1
currentVersion: 5.1.3.1
updateAvailable: "no"
upgradeCompleted: false

#### sppState:

currentVersion: 10.1.10.2709
updateAvailable: "no"
upgradeCompleted: false

#### switchState:

switches: - availableFirmwareVersion: 4.3.0 currentFirmwareVersion: 4.3.0 switchName: hspeed1-78ac99a switchRole: primary switchSerialNumber: M1LM11E000M switchType: hspeed updateAvailable: "no"

# Updating the OpenShift Software Stack

The following slides explore how different OpenShift Stacks are updated

- 1. Fusion HCI
- 2. OpenShift on a Hypervisor
- 3. OpenShfit on Bare Metal

As required by common security audits (e.g. PCI-DSS) the full software stack need to be updated including the Firmware of involved infrastructure components.

# **Updating Storage Fusion HCI**

### **Storage Fusion HCI**

Has full control of the underlaying Hardware Stack. Therefore, we can update the following components:

- Software Defined Storage
- Backup Tool
- Server Firmware (NVMe drives, Network Cards, Bios ...)
- Top of Rack Switches

### **HCI Advantages**

- All updates can be managed via the OCP and Fusion UI
- IBM delivers the full Software Stack
- This Stack is fully tested and the interoperability is ensured
- IBM provides support for the full Software Stack

### **Storage Fusion HCI**



Bare metal OpenShift Stack

# Updating OpenShift on a Hypervisor

### **OpenShift running in VMs**

- This software stack has multiple layers with multiple <u>UIs</u>
- Multiple vendors are involved for support and licensing
- The software packages and update instructions have to be obtained from multiple sources
- Interoperability of the components have to be ensured and tested. (e.g. Backup Tool -> Storage CSI -> OCP version)
- In many organizations, multiple teams are involved. Timing a change management has to be coordinated to avoid outages

Storage Team



# Updating Bare Metal OpenShift

Storage Fusion SDS on Bare Metal

### **Bare Metal OpenShift**

Can be installed via RH IPI or assisted installer. OpenShift has no control of the Hardware underneath. Firmware updates have to be done outside of OpenShift.

### **Storage Fusion SDS for Bare Metal**

Requires a user provisioned bare metal OCP Cluster. The Storage Fusion Operator is installed on this cluster, providing storage and data protection services. Storage Fusion SDS does only update its own components.

**DevOps OCP Team** 

### **Storage Fusion HCI**



# Storage Fusion HCI Upgrade Procedure

The Storage Fusion HCI upgrade procedure is divided into four steps:

- 1. Fusion management software
- 2. Fusion Services update (Storage and Backup Software)
- 3. Compute nodes and Switches firmware
- 4. OpenShift Container Platform update

# Fusion management software update (1/4)

Ree On	d Hat			:	🖬 🛕 19 🖨 🙆 kuberadmin 🗸	
_ 🗢	Red Hat				🗰 🛕 19 🖨 🙆 kubetadmin 🗸	
	Red Hat					_
*	Red Hat     OpenShift     Container Platform				🗰 🌲 19 🕞 🚱 kube:aa	dmin <del>v</del>
Hc	📽 Administrator 🛛 🔫	You	are logged in as a temporary administrative user. Update the <u>clu</u>	ister OAuth configuration to allow others	to log in.	
Ног		Project: ibm-spectrum-fusion-ns 🔻				
	Home 🗸	InstallPlans > InstallPlan details				
	Overview	nstall-6n96a Approval			Actions	- '
	Projects				Actions	•
	Search	Details YAML Components				
	API Explorer					
O(	Events	Review manual InstallPlan				
Op		Review the manual install plan for operators isf-operator.v.	2.3.0-75025164. Once approved, the following resources will be	created in order to satisfy the requireme	nts for the components specified in the plan. Click the resou	irce
	Operators 🗸 🗸	name to view the resource in detail.				
	OperatorHub	Approve Deny				
w	Installed Operators					
Wo	- Workloads 🗸	isf-operator.v2.3.0-75025164				
	Pods	Name	Kind	Status	API version	
	Deployments	CSV isf-operator.v2.3.0-75025164	ClusterServiceVersion	Unknown	operators.coreos.com/v1alpha1	
	DeploymentConfigs	CRD hooks.data-protection.isf.ibm.com	CustomResourceDefinition	Unknown	apiextensions.k8s.io/v1	
	Secrets	CRD minioobjectstores.storage.isf.ibm.com	CustomResourceDefinition	Unknown	apiextensions.k8s.io/v1	
	ConfigMaps	CRD	CustomResourceDefinition	Unknown	apiextensions.k8s.io/v1	
	CronJobs	CRD	CustomResourceDefinition	Unknown	apiextensions.k8s.io/v1	
	Jobs	deletebackuprequests.data-protection.isf.ibm.com				

# Fusion Services update (2/4)

K IBM Spectrum Fusion isf-rackb				⑦ 유 ¢ :::			
× IBM Spectrum Fusion isf-rac	kb			0	ዮ 🗘		
$\times$ IBM Spectrum Fusion isf-					<u></u>	¢.	
E Quick start	Node firmware upgrades are available			S	ee Nodes to beg	gin upgra	ading
A Events							
D Applications	Services						
C Disaster recovery	Enabling these services provides access to storage manage	ment, data sharing, application backups and					
I Cloud Satellite	data recovery.						
Infrastructure ^							
Dashboard	Global data platform By IBM	:	Data protection			:	
Nodes	This service provides crash consistent backups, access to data from	n external storage sources and Container Storage	Protect your data with application-centric backups.	Use local snapshots for quick recovery, or tr	ansfer backups to	external	
Network	Interfaces (CSI) provisioning of high performance storage.	Ungrade data protection	×				
Services	Current version Statu 5.1.3.1		09	Status			
Settings	1 Upgrade available	version 10.1.12.122. This action will take approx	ximately 30 available				
	Learn more	minutes.	re				
		Cancel Upgrade					
	View the docume	entation and learn more about					
	preparing your clu	uster for disaster recovery					

# Compute and Switch Firmware upgrade (3/4)

	IBM Spectrum Fusion	isf-rackb						?	°C	¢					
×	IBM Spectrum Fusion	isf-rc	isf-rackb							?	ĉ	<b>С</b> з			
×	IBM Spectrum Fusion	isf-rc	ackb									?	°C	<del>ل</del> ۍ	
×	IBM Spectrum Fusion	isf-ra	ackb									0	റ്	¢;	
Quick start															
Events	5		No	des											
Applic	pplications The different kinds of nodes that you can manage from the Compute page are compute storage														
Backu	ckup policies AFM, and GPU. Learn more.														
Disast	er recovery														
Cloud	Satellite	Firmware upgrade to version isf-2.3.0 is available     Eirmware upgrade available for the nodes in this appliance. Upgrades require that the node is placed in maintenance mode and rebooted one at a time. The estimated time for upgrade is 1 hour per													
Infras	tructure ^	ture node.													
Dash	board														
Node	'S		Q :	Search								A	dd disks	+	
Netw	vork			Name	State	Firmware	Description	Туре	CPU (cores)	Memory (Gib)	Rack name	Locatio	n		
Servic Settin	es gs			compute-0.isf- rackb.rtp.raleigh.ibm.com	🖉 Ready	isf-2.3.0	Node is ready for workload consumptions	Compute storage	32	256	RackB	RU5		:	
				compute-1.isf- rackb.rtp.raleigh.ibm.com	• Upgrading 50%	isf-2.1.0 - Upgrade in progress	Scheduling disabled for the node	Compute storage	32	256	RackB	RU6		:	
				compute-2.isf- rackb.rtp.raleigh.ibm.com	Ready	isf-2.3.0	Node is ready for workload consumptions	Compute storage	32	256	RackB	RU7		:	
				control-0.isf- rackb.rtp.raleigh.ibm.com	Ready	isf-2.1.0 - Upgrade available	Node is ready for workload consumptions	Compute storage	32	256	RackB	RU2		:	
				control-1.isf- rackb.rtp.raleigh.ibm.com	🖉 Ready	isf-2.3.0	Node is ready for workload consumptions	Compute storage	32	256	RackB	RU3		:	
				control-2.isf- rackb.rtp.raleigh.ibm.com	Ready	isf-2.1.0 - Upgrade available	Node is ready for work bad consumptions	Compute storage	32	256	RackB	RU4		:	

# OpenShift upgrade (4/4)



Fusion HCI System Integrated HCI lifecycle management services simplifies day-2 administration

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### A Fusion HCI System Administrator can

- Add storage to the cluster without the assistance of a storage administrator
- Apply firmware updates to switches and servers without the assistance of network or data center engineers
- Apply software and firmware updates in a rolling update fashion, without application downtime
- Monitor status of hardware and systems software

Dashboard			
Compute 🥥	$\rightarrow$	Storage 🖉 Network 🧭	÷
Nodes		Disks Switches	
8 Total	0 Critical	12 0 4 Total Critical Total	0 Critical
CPU ① 256 cores	Метоту © 1.88 тв	Raw capacity ① Backups	
OpenShift 🔮	C	Software capacity C C	
Pods 410 Total	1 Critical	Filesystem 1 % used	9 Total
Persistent volumes		33.51GB of 162.07TB	0 1 Warping Dailed
24	24		• noning • nonio
CPU	24 of 512 cores used		
Memory usage	0.57 of 1.11 TB used		



# Redbooks





### **IBM Storage Fusion**



#### Get container workloads out of pilot and into production faster

#### **CORE CAPABILITIES**



**Container Native Storage** Directly provision storage volumes through the Storage Fusion CSI interface



**Backup and restore** applications and VMs to object stores for data resiliency



**Application resiliency** via sync. or async. replication across availability zones and regions



**Simple, centralized management** of all OpenShift data services. Single pane of glass UI



#### **Storage Fusion HCI** Turnkey Bare-metal OpenShift cluster-in-a-box

#### Bare Metal is better!

Save the Hypervisor license and performance tax. Benefit from cheaper OpenShift subscriptions by licensing sockets instead of cores.

#### Fully automated installation

From power on to a production ready OpenShift in 5 hours.

#### Scalable

Starts small with 6 servers and scales up to 20. Start with 50 TB usable capacity on grow online to 900TB.

#### One point of contact

Hardware and Software support from IBM. For the full SW stack, including OpenShift, SDS Storage and Backup.



### **IBM Storage Fusion HCI** *Höchste Leistung und Sicherheit für KI- und Containeranwendungen*

#### Was ist Storage Fusion HCI?

Eine hyperkonvergente Hardware- und Softwarelösung für Red Hat OpenShift, die einfach und sicher eine hybride Containerplattform bereitstellt.

# Welche Kernfunktionen bietet Storage Fusion HCI unternehmenskritischen KI & Containeranwendungen?



#### **Container Native Storage**

Direkte Bereitstellung von performantem Speicher über die Storage Fusion CSI-Schnittstelle



#### Einfache Sicherung und Wiederherstellung

von Containern und VMs für maximale Datenausfallsicherheit mit IBM Storage Protect Plus



#### Ausfallsicherheit der Anwendung

durch synchrone oder asynchrone Replikation

#### Einfaches, zentrales Management



der Appliance, der Datensicherung sowie der OpenShift-Datendienste über eine einzige Benutzeroberfläche



#### Warum entscheiden sich Kund\_innen für Storage Fusion HCI?

#### ✓ Hervorragender ROI

Bare Metal OpenShift ist schneller und günstiger, da es ohne Hypervisorebene auskommt. **Ermöglicht 80% Einsparung bei der OpenShift-Subscription** 

#### ✓ Einfaches Deployment von Red Hat OpenShift

vom Einschalten bis zum produktionsbereiten OpenShift in wenigen Stunden

#### ✓ Herausragende Leistung

Meistert anspruchvolle Workloads mit bis zu 20 Servern, hochperformantem Datenzugriff und optionalen NVIDIA A100 GPUs

#### ✓ Data Lake Management

Schnelles **Einbinden von sowohl weit entfernten Daten als auch Cloudspeicher** durch die Integration von IBM Storage Scale

#### ✓ Einfaches Infrastruktur Management

Flexibles Skalieren der Server & Speicherkapazität, sowie Hardware- und Software-Support von IBM über den gesamten Stack, einschließlich OpenShift, Storage und Backup

