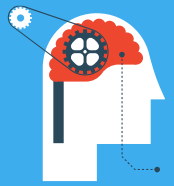


# Spectrum Scale Expert Talks

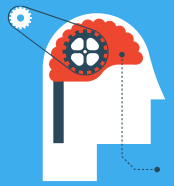
Episode 11:

## What is new in Spectrum Scale 5.1?

IBM Spectrum Scale

**Show notes:**
www.spectrumscaleug.org/experttalks

**Join our conversation:**
www.spectrumscaleug.org/join



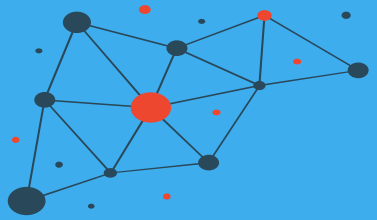
# SSUG::Digital

## Welcome to digital events!

IBM Spectrum Scale

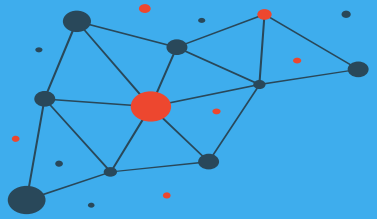
**Show notes:**
www.spectrumscaleug.org/experttalks

**Join our conversation:**
www.spectrumscaleug.org/join



# About the user group

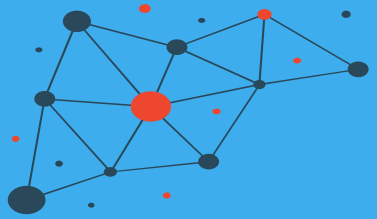
- Independent, work with IBM to develop events
- Not a replacement for PMR!
- Email and Slack community
- https://www.spectrumscaleug.org/join



# We are …

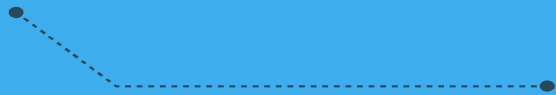
- Simon Thompson (UK)
- Kristy Kallback-Rose (USA)
- Bob Oesterlin (USA)
- Bill Anderson (USA)
- Chris Schipalius (Australia)

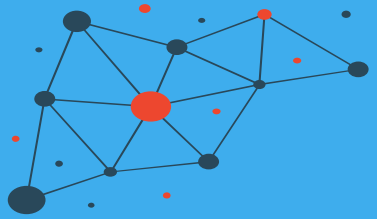
IBM CHAMPION



# Check https://www.spectrumscaleug.org/experttalks for charts, show notes and upcoming talks

- Past talks:
  - 001: What is new in Spectrum Scale 5.0.5?
  - 002: Best practices for building a stretched cluster
  - 003: Strategy update
  - 004: Update on performance enhancements in Spectrum Scale (file create, MMAP, direct IO, ESS 5000)
  - 005: Update on functional enhancements in Spectrum Scale (inode management, vCPU scaling, NUMA considerations)
  - 006: Persistent Storage for Kubernetes and OpenShift environments
  - 007: Manage the lifecycle of your files using the policy engine
  - 008: Multi-node scaling of AI workloads using Nvidia DGX, OpenShift and Spectrum Scale
  - 009: Continental: Deep Thought – An AI Project for Autonomous Driving Development
  - 010: Data Accelerator for Analytics and AI (DAAA)
- Today:
  - Nov 18: What is new in Spectrum Scale 5.1.0?
- Next:
  - Dec 4: Event driven data management and security using Spectrum Scale Clustered Watch Folder and File Audit Logging





# Speakers

- Chris Maestas (IBM)
- Ismael Solis Moreno (IBM)

# IBM Spectrum Scale
Release Update 5.1.0

Chris Maestas
Executive Architect

Ismael Solis
Spectrum Scale Performance Analyst

IBM

# Disclaimer

IBM Spectrum Scale

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# Spectrum Scale 5.1.0 Featured Updates

IBM Spectrum Scale

Set Quality of Service for projects at the fileset directory level to ensure expected operations and bandwidth are available.

Provide Data Acceleration for AI and Analytics (DAAA) using a High Performance Tier (HPT) and connect to cloud storage environments seamlessly with S3.

Enhanced container support for high performance.

Simplified File Audit Logging and Watch Folder support to work with technologies like QRadar and Splunk to detect unauthorized access and similar inotify-like events.

Support latest technologies like IPV6 and NFS 4.1

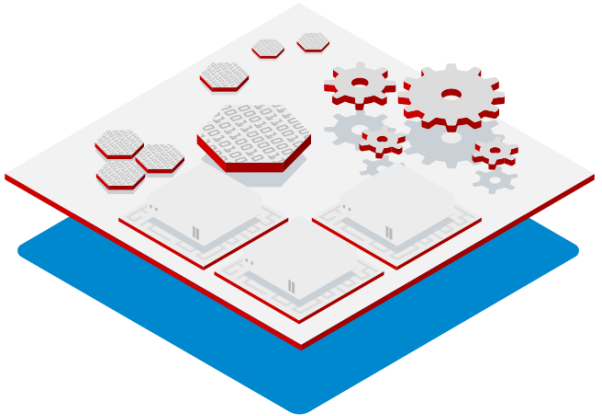
# Platform Updates

IBM Spectrum Scale

**Support the latest Operating Systems as quickly as possible and Next generation DevOps and Networking support:**

The following operating systems are supported in this release:

- Red Hat Enterprise Linux 7.7, 7.9 (x86_64, PPC64LE, s390x).
- Red Hat Enterprise Linux 8.1, 8.2 (x86_64, PPC64LE, s390x).
- SLES 15 (x86_64, s390x).
- Ubuntu 20.04 (x86_64, PPC64LE).
- AIX 7.2.
- Windows 10, Server 2016, Server 2019.
- The hardware compression feature zEDC on IBM z15 is supported.



- All Python code in the IBM Spectrum Scale 5.1.0 product is converted to **Python 3**. The minimum supported Python version is 3.6. This means powerful toolkit and libraries.

- **IPv6 Support** for protocol nodes.

# Installation Toolkit Changes

**Wider support for the installation toolkit, making your installation process easier across different platforms and versions:**

- Support for Ubuntu 20.04 on x86_64.
- Support for Red Hat Enterprise Linux® 7.9 on x86_64, PPC64LE, and s390x.
- Support for file audit logging, NFS and SMB protocols, and CES on SLES 15 on x86_64 and s390x.
- Support for installing and upgrading AFM to cloud object storage (***gpfs.afm.cos***) package.

# Spectrum Scale Core Improvements

IBM Spectrum Scale

## Administration and reliability

### Simpler administration and stronger reliability:

- The ***mmlslicense*** command now supports integration with ILMT. It will help you to manage your Scale software licensing requirements and maintain an audit ready posture.
- Now you can **change demon IP for a quorum node in CCR-enable clusters** proving you a simpler administration. This was not possible in earlier versions.
- Cancellation timeout for long-waiting RDMA requests with the ***verbsHungRdmaTimeout*** attribute from the ***mmchconfig*** command. Clean up long wait RDMA threads due to HW fails with a simple command.
- **Protection against accidental loss of node quorum** by warning and asking for confirmation of shutting down quorum nodes. Enhance your system reliability by avoiding accidental downtime.

# Spectrum Scale Core Improvements

IBM Spectrum Scale

## Features

### Tools for more flexible administration and simpler utilization:

- The ***mmcheckquota Device:Fileset*** command supports the execution against a particular inode space. This will help you to check and recover quota usage in a more flexible way (fileset level).

- Now you can ignore the data replication factor for the output of **df** and **quota** commands by configuring the **ignoreReplicationOnStatfs** and **ignoreReplicationForQuota** attributes of the **mmchconfig** command. This make it easier to use. You decide whether to see the output of commands considering the replication factor.

# Spectrum Scale Core Improvements

IBM Spectrum Scale

## Features

### Faster and reliable data recovery:

- Enhanced performance of parallel log recovery process using new tuning parameters included in ***mmchconfig*** such as: ***logRecoveryThreadsPerLog, logOpenParallelism*** and ***logRecoveryParallelism***. You can tune the number of log files and threads per log file to achieve faster recovery.

- Use the **gpfs.readReplicaRule** extended attribute to select specific data block replicas to read from user files. This will help you to achieve faster recovery from replica mismatches.

# Spectrum Scale Core Improvements

## QoS Updates!

**Give projects the right operations and bandwidth they need!**

- Supports user-created service classes and dynamic I/O service sharing for filesets.

```
[root@c40bbc4xn10 bin]# ./mmqos class create qos4 --class HR_Dept_1 --fileset fstest1
mmqos: Processing the new QoS configuration...
mmqos: File System Manager QoS service validating the configuration (host is c34f2n05.gpfs.net)...


mmqos: Validation complete.
mmqos: The configuration data was written to the CCR successfully
mmqos: Calling the daemon to update the configuration within the cluster...

QOS configuration has been installed and broadcast to all nodes.

mmqos: Daemon update is complete.
mmqos: Command completed.
```

- The new ***mmqos*** command combines the functionality of the existing ***mmchqos*** and ***mmlsqos*** commands.

```
[root@c40bbc4xn10 bin]# ./mmqos class list qos4
 Class Name                     Class Type     Fileset Name
-------------------------------------------------------------
maintenance                     system         --
other                           system         --
misc                            system         --
mdio-all-sharing                system         --
HR_Dept_1                       user           fstest1,fstest2
```

Simpler usage!!

```
Usage:
  mmqos
    class
      create        Device --class ClassName [--fileset FilesetName[,FilesetName...]]
      update        Device --class ClassName { {--add | --replace} --fileset FilesetName[,FilesetName...]
                                             --remove --fileset FilesetName }
      delete        Device --class ClassName
      set           Device --class ClassName Attribute=Value[,Attribute=Value...]
      list          Device [--config] [-Y]
    throttle
      create        Device --pool PoolName --class ClassName
                    [{ -N {Node | NodeClass} | -C {all | all_local | all_remote | ClusterName} }]
                    [--maxIOPS MaxIOPS] [--maxMBS MaxMBS]
                    [--force]
      update        Device --pool PoolName --class ClassName
                    [{ -N {Node | NodeClass} | -C {all | all_local | all_remote | ClusterName} }]
                    [--maxIOPS MaxIOPS] [--maxMBS MaxMBS]
                    [--force]
      updateKey     Device --pool PoolName --class ClassName
                    [{ -N {Node | NodeClass} | -C {all | all_local | all_remote | ClusterName} }]
                    { --new-N {Node | NodeClass} | --new-C {all | all_local | all_remote | ClusterName} }
      delete        Device --pool PoolName --class ClassName
                    [{ -N {Node | NodeClass} | -C {all | all_local | all_remote | ClusterName} }]
      list          Device [{--pool PoolName | --class ClassName}] [-Y]
    config
      set           Device Attribute=Value[,Attribute=Value...]
      list          Device [-Y]
    filesystem
      init          Device
      enable        Device
      disable       Device
      reset         Device
      refresh       Device
      list          [-Y]
      status        Device [-Y]
      restore       --restore-file RestoreFile
    report
      list          Device [--pool {all | PoolName}] [--seconds Seconds] [--sum-classes {yes | no}]
                    [--sum-nodes {yes | no}] [{-Y | --fine-stats-display-range FineStatsDisplayRange}]
```

# Spectrum Scale Core Improvements

IBM Spectrum Scale

## Performance

### Fastest Filesystem operations:

- Automating background space reclamation for thin-provision devices. You can configure a threshold value to define how often you want the background space reclamation to run. **Up to 60%** on performance degradation reduction for NAND-flash based SSD media.

- Enhancements to improve performance for I/O workloads that generate lot of files such as untar and make operations in the **AFM** Cache Cluster. **Up to 40%** of improvement for file create operations.

- Enhancements to dynamically rebalance QoS shares between classes by the I/O workload weight. Better performance among data pools due to resources rebalancing.

# IBM Spectrum Scale Erasure Code Edition Changes

## Extended storage capacity and enhanced procedures for problem solving:

- **Support for up to 40 drives per storage node**. This will allow you to increase your storage capacity.
- New **checking point for slot location** in daemon. This will help you to reduce issues during the system maintenance. Noticing a **pdisk** have wrong slot location code before creating a RG.
- **Physical disk procedures** revised to include the steps for determining the disks that have a problem. This will make simpler to detect and correct disk issues.
- **Procedure for adding new recovery group** into the existing IBM Spectrum Scale Erasure Code Edition cluster. It will help you to efficiently extend the capacity of your cluster.
- **Troubleshoot section is enhanced** to address recovery groups, suspended node, and disks issues. This will help you in the debugging and resolution of system problems.

# Management GUI and API Changes

IBM Spectrum Scale

## Simpler system administration and reduction of manual procedures:

- Support for enabling and disabling clustered watch.
- Allowing IPv6 addresses administration for nodes of the cluster in GUI and REST APIs.
- Adding an option to keep nodes of the cluster in **maintenance mode**. This helps the system to avoid raising a critical event that affects the health status of the system
- **Several endpoints additions for management API** including COS, watch and AFM. This provides you a wide variety of tools to efficiently administrate your system. Please refer to the Knowledge Center to review the full list.

# Monitoring, Availability, and Proactive Services (MAPS) Updates

IBM Spectrum Scale

## System Health & Monitoring

### More detailed information about your system health:

- **TIPing for insufficient RAM** if CES is used. Get notified when running out of memory on CES nodes and reduce stability problems.
- Improving alerting for GPFS crashes. Get notified when **mmfsd** terminated abnormally. This will allow you to get operational faster.
- Hardened mounts monitoring. Reduce false positive TIPs **not_default_mountpoint** and rely on more accurate notifications.
- **rpcbind/rpc.statd** checking for NFS monitor. Reduce timeouts when checking for NFS service availability. Therefore, reliable NFS status.

# Monitoring, Availability, and Proactive Services (MAPS) Updates

IBM Spectrum Scale

## System Health & Monitoring

### More detailed information about your system health:

- Detecting of **filesystem managers** / movements. Be aware of the movements in the filesystem managers to maintain your system healthy.
- QoS state/perfmon state monitoring. Now the status of these services in one glance.
- For ESS5K: **NVRAM devices** monitoring. This will help you to know the health of your underlying storage devices.
- New **VFS metrics** including **min/max latency** for VFS operations to better analyze performance issues
- QoS integration to provide **historical performance**. This will allow you to analyze the performance of defined classes in a period of time and adjust accordingly.

# Monitoring, Availability, and Proactive Services (MAPS) Updates

IBM Spectrum Scale

## Call Home

**More data insights and simpler call home installation and management:**

- Eliminating any feature-specific packages to be installed anymore. The call home feature can be configured and used after the IBM Spectrum Scale **gpfs.base** package is installed.
- Adding a cluster summary in **ECuRep**. Detailed information on your cluster to provide efficient support.
- Increasing to 8GiB the limits for **Call Home Uploads**. This means  more info to debug and resolve system problems.
- Enabling and disabling **event-based uploads** on a **cluster-wide level**. This provides simpler call home administration. No more manually node by node configuration.

# Protocol Improvements

## NFS & NFS Authentication

IBM Spectrum Scale

### More reliable and secure NFS protocol access:

- **Support for NFS Version 4.1**. Better handling of dropped connections, directory delegation, and parallel I/O for increasing scalability and overall performance.
- Support for NFS on SUSE SLES 15 on s390x (**RPQ Request required**).
- Support for the configuration of authentication with **IPv6** address of external authentication servers. More flexibility to integrate auth mechanisms.
- LDAP-based authentication schemes secure the integration with the LDAP authentication server over **TLS**. That is, even more secure connections.
- LDAP-based authentication scheme uses **SSSD** for the integration with the LDAP authentication server. This Reduces load on identity and authentication servers, and allows cached base offline auth.

# Protocol Improvements

IBM Spectrum Scale

## SBM & Object

### Faster and Flexible SMB protocol access:


- Support for SMB upstream version 4.12. This will allow to notice performance and copy speed improvements added in version 4.12 due to de inclusion of GnuTLS, samba-tool improvements among others.

- Support for SMB on SUSE SLES 15 on s390x (**RPQ Request required**). This provides, extended flexibility on SMB deployments for Z Systems.

- The object protocol support updates and support upcoming in  5.1.0-1 PTF.

# Container storage interface (CSI) 2.X!

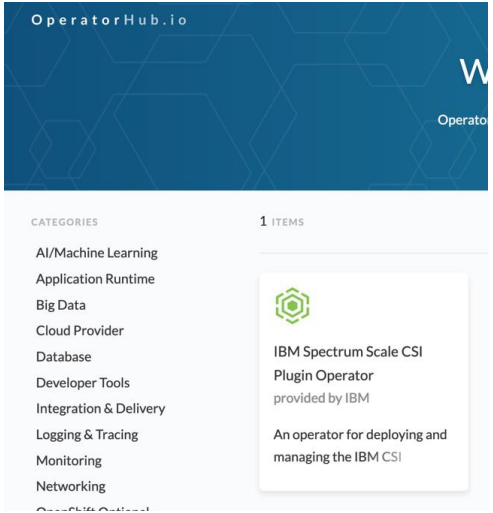
IBM Spectrum Scale

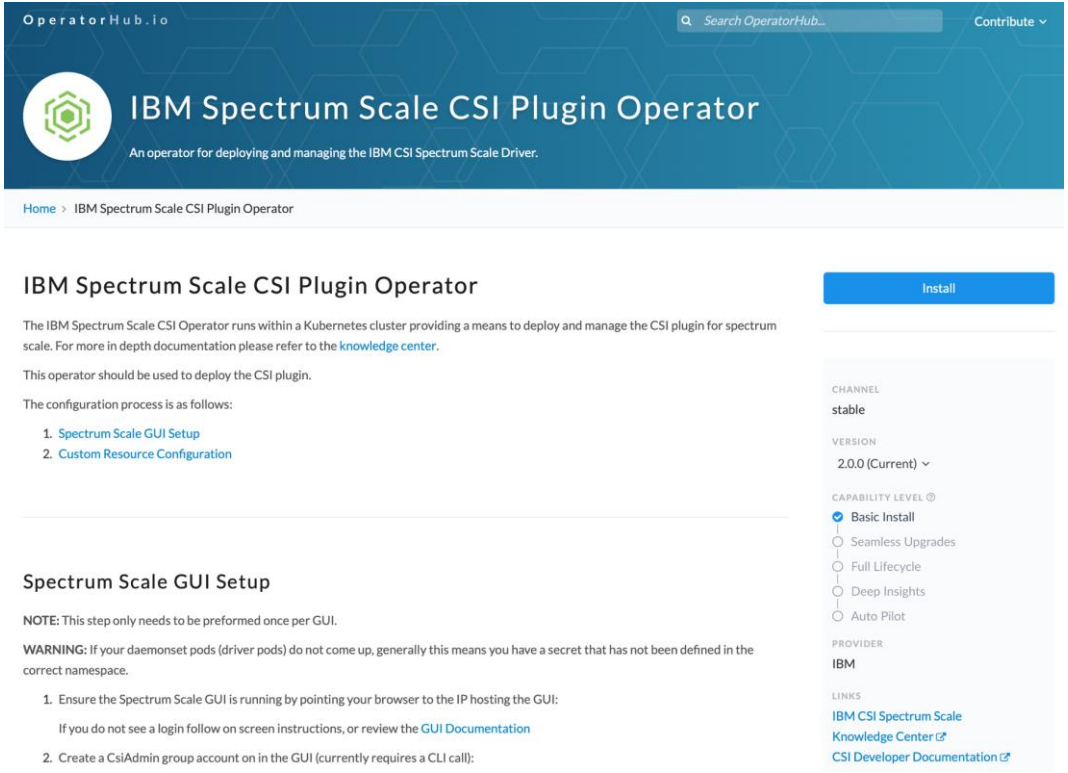
## Standardized support for container support!

- Support for Red Hat® OpenShift® 4.4, 4.5, and Kubernetes 1.18.
- Improved custom resource parameter validation and error messages.
- Improvements in the debug data collection tool.
- Made the clusterId parameter optional in storageClass (default: Primary Cluster ID).
- Upgraded the ansible-operator version from v0.14.0 to v0.17.0
- Support for imagePullSecrets.

# Container storage interface (CSI) 2.X!

## Easy to deploy and open source to give feedback for improvement!



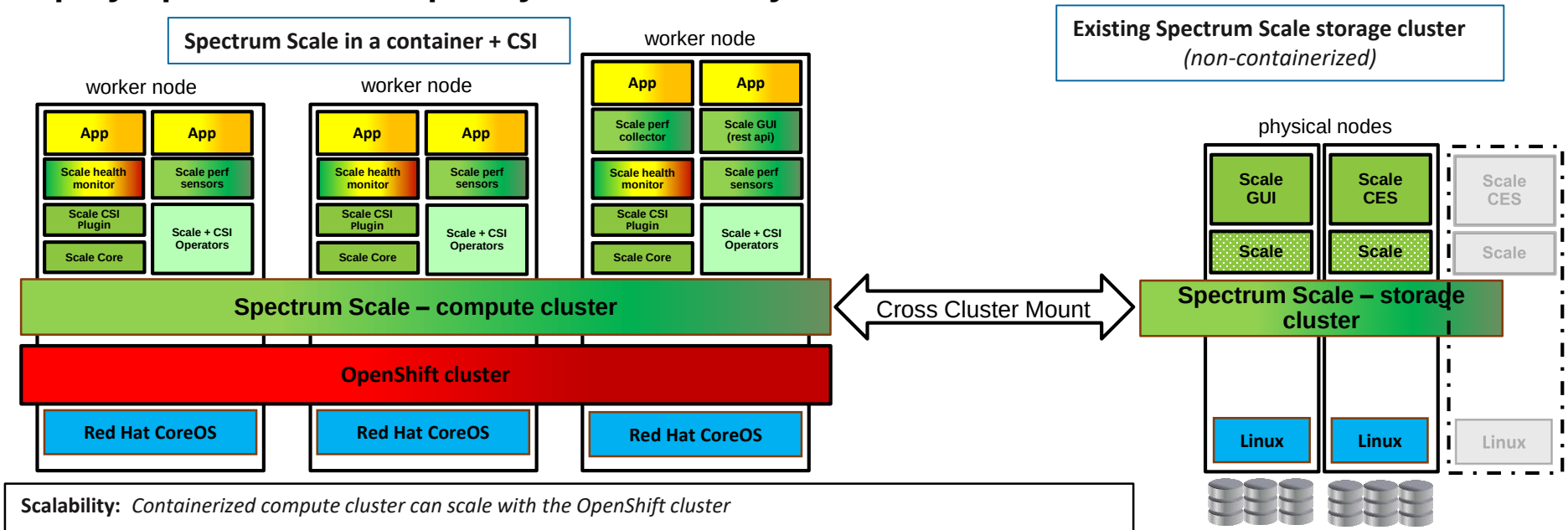




**Available on OperatorHub ever since our first GA in December of 2019**

**it's open source – customers can contribute through github:** *https://github.com/ibm/ibm-spectrum-scale-csi*

# Container native storage access – Coming Soon

## Deploy Spectrum Scale quickly and efficiently




**Scalability:** *Containerized compute cluster can scale with the OpenShift cluster*

**Speed:** *R/W benchmarks of Spectrum Scale CSI have shown same performance as non-containerized Spectrum Scale*

**Container Native:** *Classic Spectrum Scale has been separated into its fundamental components and built from the ground up with containerization of each component in mind. Spectrum Scale now 'lives' next to customer application containers.*

**Automation:** *Spectrum Scale and CSI operators allow automated cluster and storage provisioning*

**Flexibility:** *Existing Spectrum Scale, ESS, ECE, clusters are used as storage via a remote mount, independent of OpenShift*

**Open standards:** *CSI provides an open standard for direct access to Spectrum Scale storage*

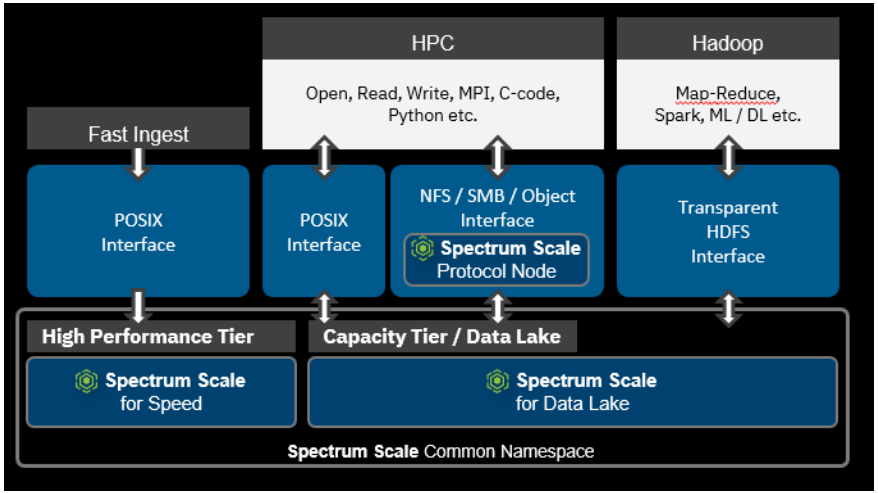
# Big Data and Analytics Enhancements

IBM Spectrum Scale

Spark

CLOUDERA

hadoop




- Extend HPC to modern analytics capabilities
- Ingest fast and improve time to insight
- Control cluster sprawl
- Transparently connect to HDFS and POSIX
  - Cloudera Private Cloud Base
  - OpenSource Hadoop

# Big Data and Analytics Enhancements

IBM Spectrum Scale

## Simpler Configuration:

- **HDFS Transparency 3.1.1-2** Includes Hadoop scripts to create users and groups in IBM Spectrum Scale and create Kerberos principals and keytabs.


## Improved Performance:

- **For HDFS Transparency 3.1.0-6** using fine-grained file system locking mechanism when Ranger is enabled.
- **For HDFS Transparency 3.1.0-6 & 3.1.1-2 using** multi-threaded summary operations based on number of files and sub-directories.

## Enhanced Administration for HDP:

- **In Mpack 2.7.0.8** avoid overwriting existing IBM Spectrum Scale tunables using the parameter **gpfs.storage.type=shared**.
- **In Mpack 2.7.0.7** Ambari now supports rolling restart for NameNodes and DataNodes.

# AFM Updates

IBM Spectrum Scale

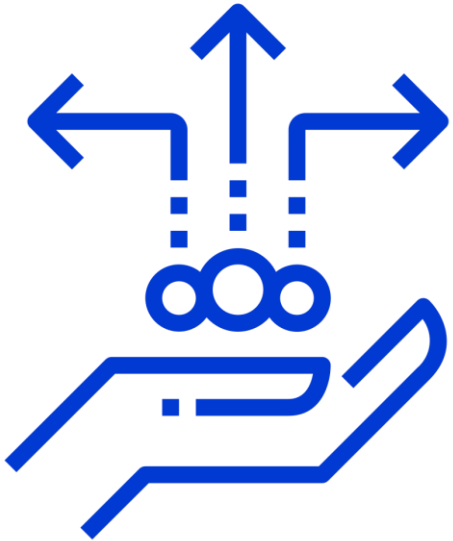
## Fast, secure and transparent data movement:

- **Support for file system-level migration by using AFM**. It allows transparent migration of data from any legacy appliances or old GPFS system to the latest IBM Spectrum Scale cluster.

- Fastest file system-level migration by setting the "***afmGateway***" parameter value to *all.* It helps load balance operations among the full gateway list by using inode number.

- *New* AFM-DR pre-deployment reference checklist. Set of guidelines to get the best of AFM.

- AFM support when the kernel is booted in the FIPS mode. Allowing more secure data processing.



# AFM Updates

## AFM to Cloud Storage – Data Acceleration for AI and Analytics (DAAA) for your High Performance Tier (HPT)

Enables placement of files or objects in an IBM Spectrum Scale cluster to a cloud object storage for workloads such as mobile applications, backup and restore, enterprise applications, and big data analytics.

- **Fastest computation** at cache and further synchronization with object storage.
- Both cache and object storage can be use as **backup**.
- **Free Spectrum Scale storage capacity** by moving less useful data to the cloud storage.

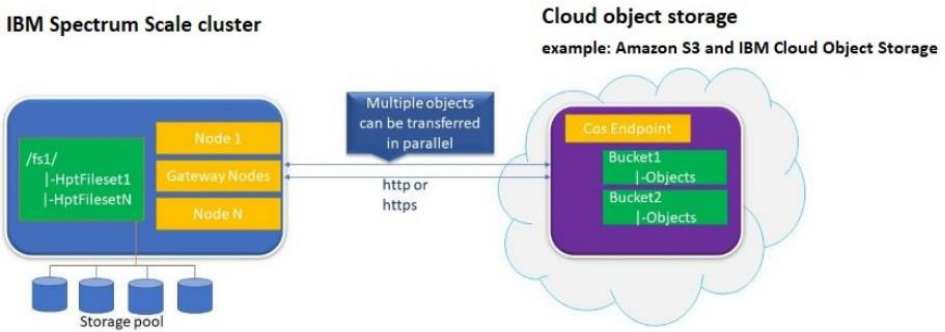
HOME cluster – Create a bucket BUCKETNAME, ACCESSKEY, SECURITYKEY

CACHE cluster –

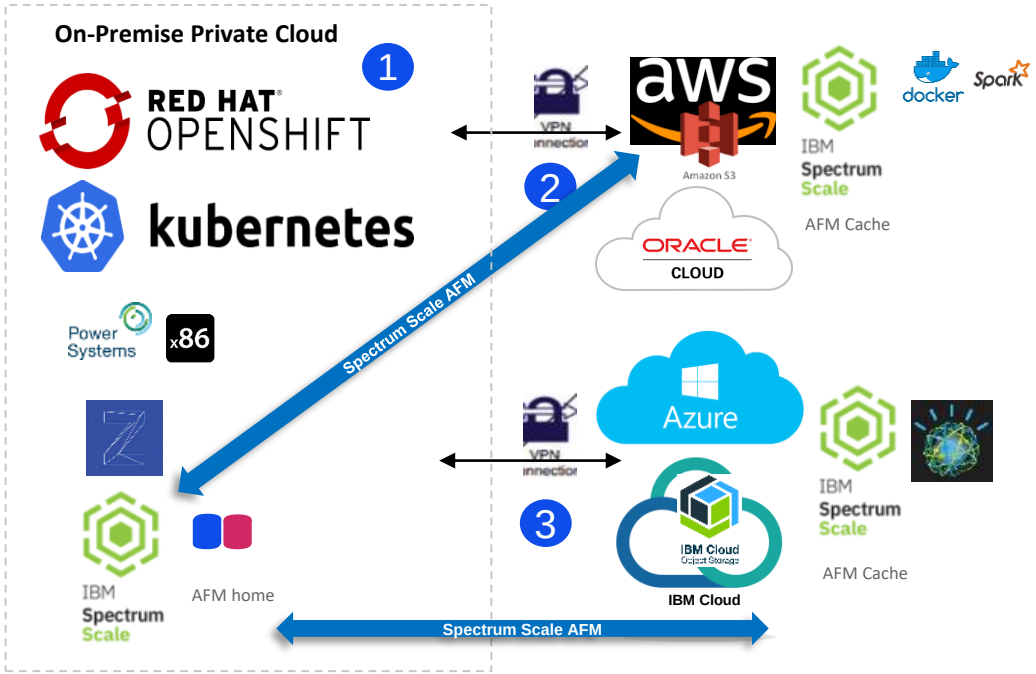
– Create a gateway
**mmchnode -gateway -N HOSTNAME**

– Create fileset

- **# mmafmcoskeys $BUCKETNAME set $ACCESSKEY $SECURITYKEY**
- **# mmafmcosconfig $FSNAME $FILESETNAME **
- **--endpoint https://URL --xattr –bucket $BUCKETNAME**



# Hybrid Cloud Workflows: Data Agility and Collaboration using AFM




1. On-Premises Private Cloud Using:
- IBM Spectrum Scale
- RedHat OpenShift / Kubernetes
- Power / x86 / Z

2. IBM Spectrum Scale automated deployment using Terraform and Ansible leveraging AWS EC2 instance and EBS volumes. Data mobility via IBM Spectrum scale Active File Management for collaboration

2. Connect and share to AWS S3

3. Deployed using IBM Bare Metal servers and block storage. Data mobility via IBM Spectrum scale Active File Management for Data analytics using IBM Cloud Private for Data and Watson analytics.

3. Connect and share to IBM COS

# Spectrum Scale Core Improvements

IBM Spectrum Scale

## Encryption & Security

### Simpler, stronger and more flexible security:

- Support for **CA-signed client certificates**. This simplifies updating client certificates in one step.

- The ***encryptionKeyCacheExpiration*** attribute specifies the refresh interval of the file system encryption key cache. Providing a more flexible security administration.

- The ***nistCompliance*** attribute must be set to NIST 800-131A for clusters running at version 5.1 or later. These recommendations provide stronger security at the transport layer.

- Sudo wrapper security improvement. You no longer need to add the ***scp***, ***echo***, and ***mmsdrrestore*** commands to the sudoers file. This means, more transparent administration and easier security configuration.

# File Audit Logging Improvements

IBM Spectrum Scale

## Enhanced control over your file operations:

- The new ***ACCESS_DENIED*** **event.** It helps to identify unauthorized user attempts to access a file for an operation that the user does not have the necessary permissions for (POSIX only).

- File audit logging **no longer requires a message queue** in IBM Spectrum Scale 5.1.0. Therefore, Kafka rpms, broker or zookeeper nodes, and extra local node space are no longer necessary. Thus, simpler administration.

- Integration with technologies like
  - Qradar -
    - http://www.redbooks.ibm.com/redpapers/pdfs/redp5560.pdf
    - https://youtu.be/Zyw84dvoFR8
  - Splunk – video available soon

# Discontinued Features

IBM Spectrum Scale

| Category | Discontinued Functionality | Recommended Action |
|---|---|---|
| GUI/REST API | The use of TLS 1.0 and 1.1 for authorization with the GUI/REST API server. | Upgrade to TLS 1.2 or later. |
| Platforms | Encryption acceleration library for Power7 (CLIC). | If encryption performance is critical, migrate to newer generations of Power systems. |
| | Big Endian Power servers. | Upgrade to newer generations of Power systems or remain on IBM Spectrum Scale 5.0.5. |
| Security | The use of TLS 1.0 and 1.1 for authorization within and between IBM Spectrum Scale clusters. | Upgrade to TLS 1.2 or later. |
| Protocols | iSCSI as a target for remote boot. | Use some other block services provider. |
| Containers | Storage Enabler for Containers (SEC). | Migrate to Container Storage Interface (CSI). |

# Deprecated Features

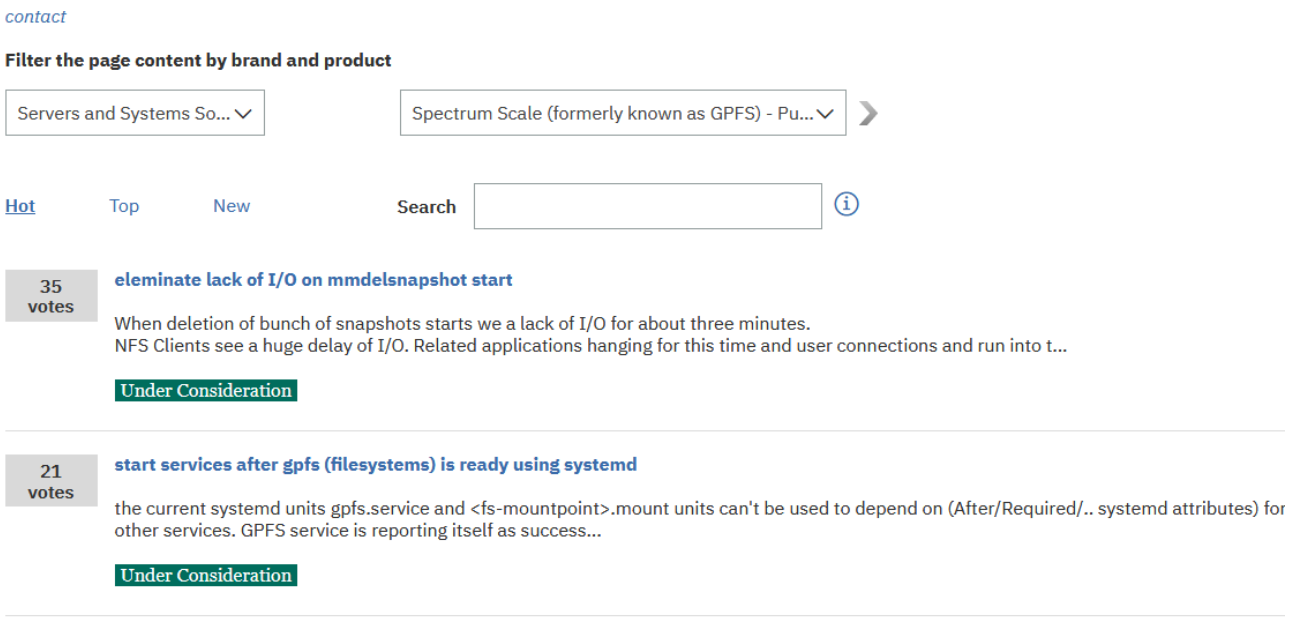
IBM Spectrum Scale

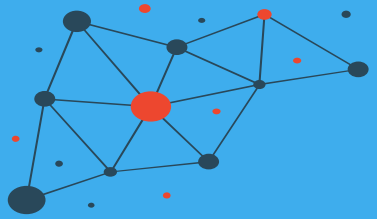
| Category | Deprecated Functionality | Recommended Action |
|---|---|---|
| Security | Support for Vormetric DSM V5. | Upgrade to Vormetric DSM V6.2 or later. |
| Watch folders | Kafka queue for watch folders. | If you are using Kafka for other purposes, install it separately from IBM Spectrum Scale. |
| Platforms | Support for IBM Power7 systems. | Plan to migrate to newer generations of Power systems. |
| Protocols | mmcesdr command (Protocols cluster disaster recovery). | Use AFM and AFM DR to set up your own replication strategies between clusters. |

# Log your RFE!

https://www.ibm.com/developerworks/rfe/execute?use_case=productsList

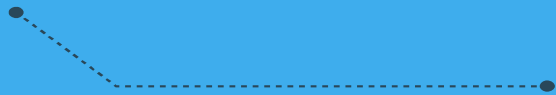
- Spectrum Scale (formerly known as GPFS) - Private RFEs
- Spectrum Scale (formerly known as GPFS) - Public RFEs





# Check https://www.spectrumscaleug.org/experttalks for charts, show notes and upcoming talks

- Past talks:
  - 001: What is new in Spectrum Scale 5.0.5?
  - 002: Best practices for building a stretched cluster
  - 003: Strategy update
  - 004: Update on performance enhancements in Spectrum Scale (file create, MMAP, direct IO, ESS 5000)
  - 005: Update on functional enhancements in Spectrum Scale (inode management, vCPU scaling, NUMA considerations)
  - 006: Persistent Storage for Kubernetes and OpenShift environments
  - 007: Manage the lifecycle of your files using the policy engine
  - 008: Multi-node scaling of AI workloads using Nvidia DGX, OpenShift and Spectrum Scale
  - 009: Continental: Deep Thought – An AI Project for Autonomous Driving Development
  - 010: Data Accelerator for Analytics and AI (DAAA)
- Today:
  - Nov 18: What is new in Spectrum Scale 5.1.0?
- Next:
  - Dec 4: Event driven data management and security using Spectrum Scale Clustered Watch Folder and File Audit Logging

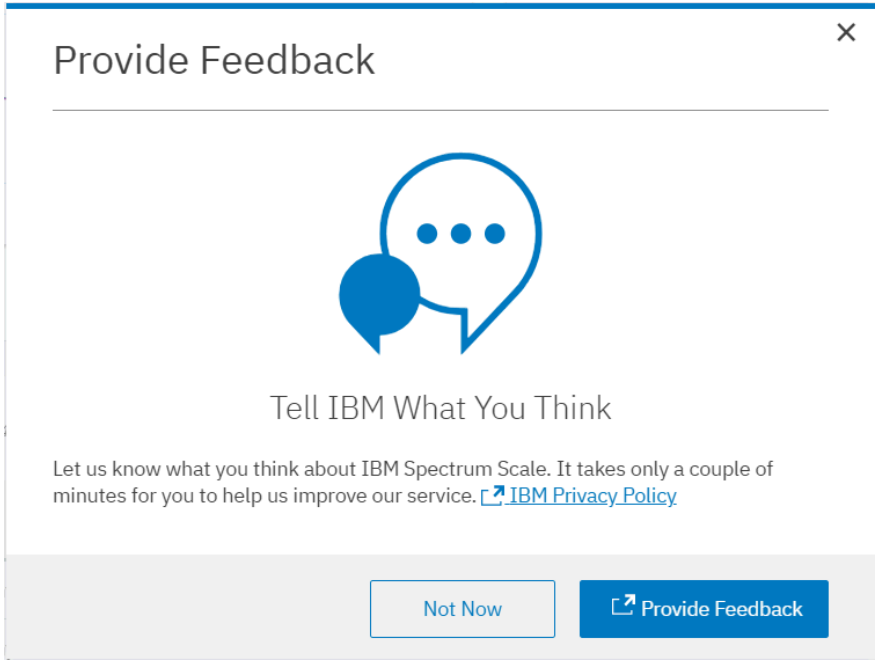


# Thank you!

IBM Spectrum Scale

Please help us to improve Spectrum Scale with your feedback

- If you get a survey in email or a popup from the GUI, please respond
- We read every single reply




## Spectrum Scale User Group

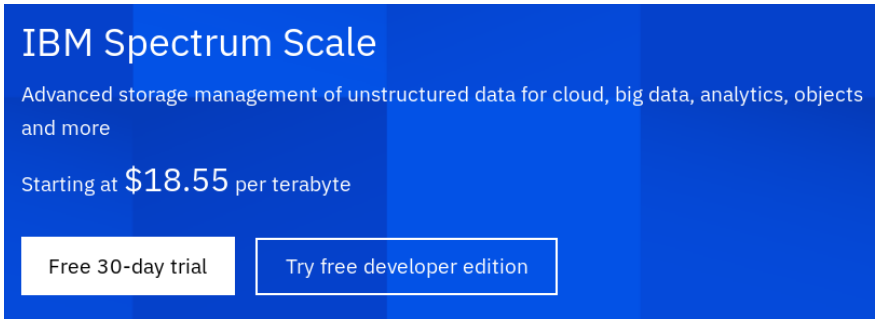
The Spectrum Scale (GPFS) User Group is free to join and open to all using, interested in using or integrating IBM Spectrum Scale.

The format of the group is as a web community with events held during the year, hosted by our members or by IBM.

See our web page for upcoming events and presentations of past events. Join our conversation via mail and Slack.

**www.spectrumscaleug.org**

# Spectrum Scale Developer Edition!




## Fully functional!

- Based on first PTF of a release
- Derived from **Data Management Edition (DME)**
- Limited to 12 TBs:
  enough for a small test cluster
- Available from the Scale ”try and buy” page on ibm.com

## Free for non-production use, e.g. test, learning, upgrade prep…

- If you have to ask, it’s probably not permitted

## Not formally supported

# Spectrum Scale Early Programs

IBM Spectrum Scale

Types of Programs:

### Alpha

Influence the development of new technology by gaining before market access to product code. Alpha programs are typically confidential and the first opportunity for you to interact with a feature or function.

### Beta

Try out a new offering with the team who owns the product and influence its usability and design. A Beta program gives you the ability to evaluate and provide feedback on IBM products before the products general availability. Beta programs are typically confidential and run prior to GA.

### Early Support Program (ESP)

Be one of the few selected participants to validate new Software or Hardware and potentially give your enterprise an edge over the competition. The IBM early support programs give you and IBM the opportunity to develop, evaluate, and gain experience with a product or a set of products in your enterprise environment.

### Customer Success

- ❑ Evaluate new IBM HW or SW in your environment.
- ❑ Validate procedures and interoperability with other products in your enterprise.
- ❑ Opportunity to Influence Product Design
- ❑ Early Enablement and education
- ❑ Strengthen Partnership with IBM

Talk to your IBM contact or Partner to be nominated!

# Spectrum Scale on GitHub!
# https://github.com/IBM/SpectrumScaleTools

- IBM Spectrum Scale Bridge for Grafana
- IBM Spectrum Scale cloud install
- IBM Spectrum Scale Container Storage Interface driver
- IBM Spectrum Scale install infra
- IBM Spectrum Scale Security Posture
- Oracle Cloud Infrastructure IBM Spectrum Scale terraform template
- SpectrumScale_ECE_CAPACITY_ESTIMATOR
- SpectrumScale_ECE_OS_OVERVIEW
- SpectrumScale_ECE_OS_READINESS
- SpectrumScale_ECE_STORAGE_READINESS
- SpectrumScale_ECE_tuned_profile
- SpectrumScale_NETWORK_READINESS

Find open source tools that are related with IBM Spectrum Scale.

Unless stated otherwise, the tools compiled in this list come with no warranty of any kind from IBM.

# Check out the FAQ!

https://www.ibm.com/support/knowledgecenter/en/STXKQY/gpfsclustersfaq.html
https://www.ibm.com/support/knowledgecenter/STXKQY/gpfsclustersfaq.pdf?view=kc
https://www.ibm.com/support/knowledgecenter/SSYSP8/gnrfaq.html


HTML or PDF

Spectrum Scale version compatibility with OS or kernels

Updated regularly!