

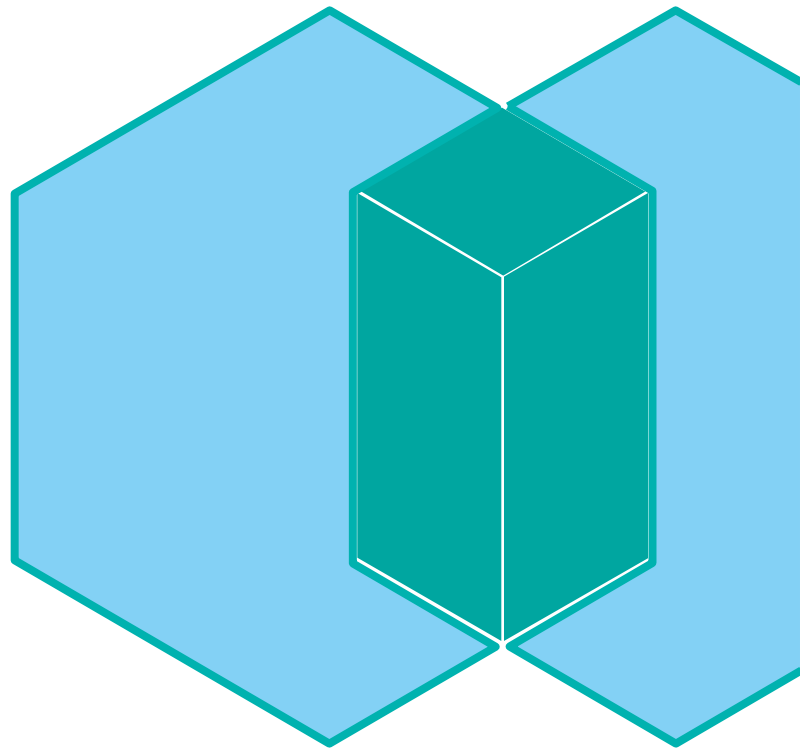


IBM Spectrum Scale

– New and Future –

Spectrum Scale User Group Meeting 2016

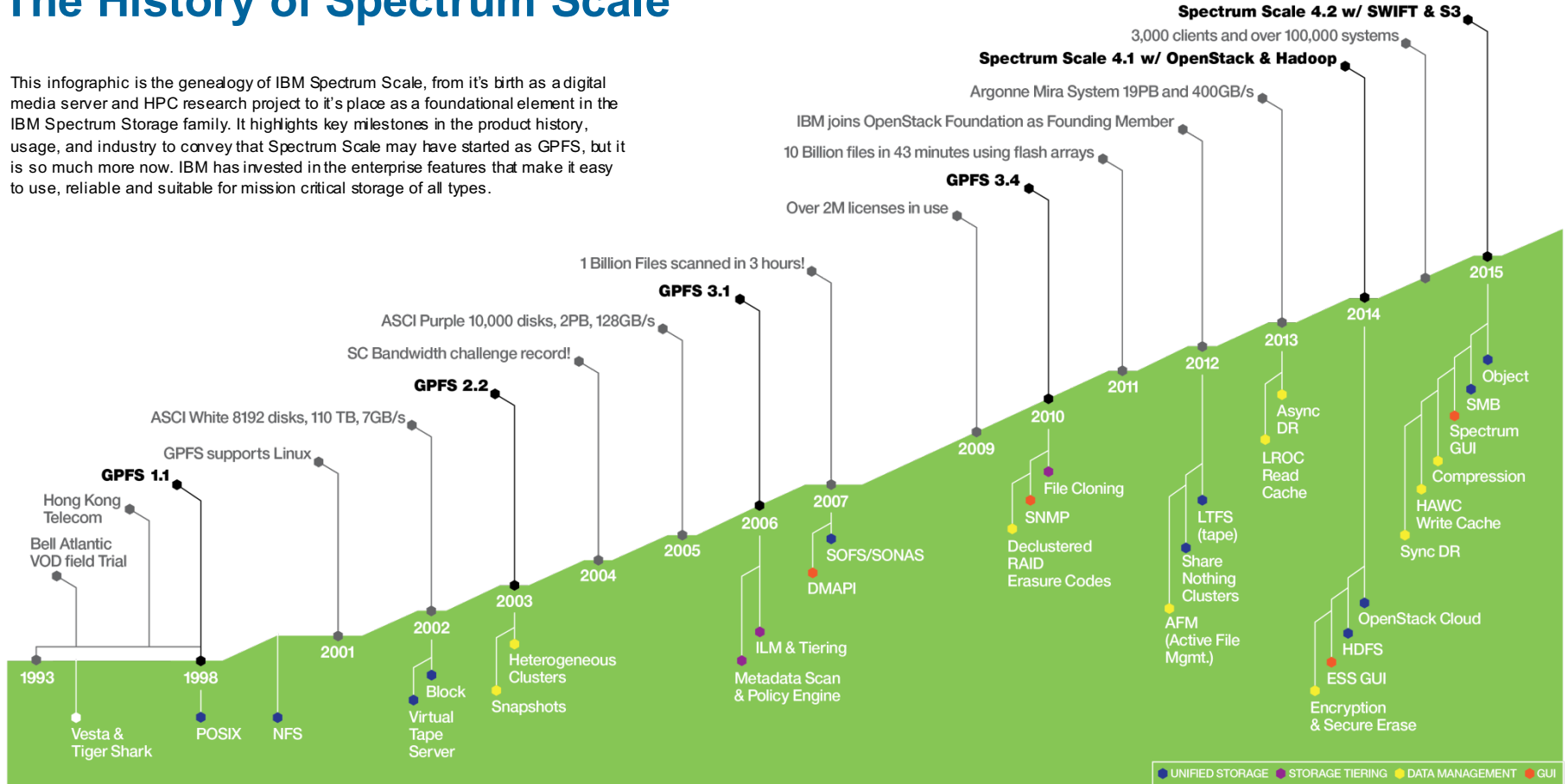
Argonne National Labs, June 10, 2016 – Scott Fadden



NEW IN SPECTRUM SCALE 4.2

The History of Spectrum Scale

This infographic is the genealogy of IBM Spectrum Scale, from its birth as a digital media server and HPC research project to its place as a foundational element in the IBM Spectrum Storage family. It highlights key milestones in the product history, usage, and industry to convey that Spectrum Scale may have started as GPFS, but it is so much more now. IBM has invested in the enterprise features that make it easy to use, reliable and suitable for mission critical storage of all types.



UNIFIED STORAGE STORAGE TIERING DATA MANAGEMENT GUI

Store everywhere. Run anywhere.

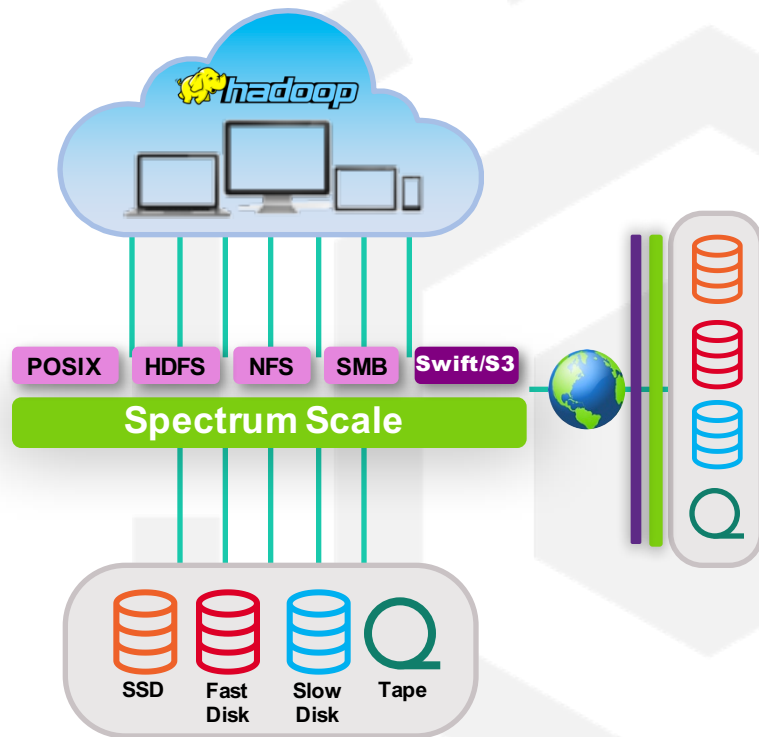
Remove data-related bottlenecks

Challenge

- Managing data growth
 - Lowering data costs
 - Managing data retrieval & app support
 - Protecting business data

Unified Scale-out Data Lake

- File In/Out, Object In/Out; Analytics on demand.
- High-performance native protocols
- Single Management Plane
- Cluster replication & global namespace
- Enterprise storage features across file, object & HDFS



Store everywhere. Run anywhere.

Content Repositories

Challenge

Object storage for static data

- Seamless scaling
- RESTful data access
- Object metadata replaces hierarchy
- Storage efficiency

Spectrum Scale Swift & S3

- High-performance for object
- Native OpenStack Swift support w/ S3
- File or object in; Object or file out
- Enterprise data protection
- Spectrum Scale RAID (ESS)
- Transparent ILM
- Encryption of data at rest and Secure Erase



Store everywhere. Run anywhere.

Analytics without complexity

Challenge

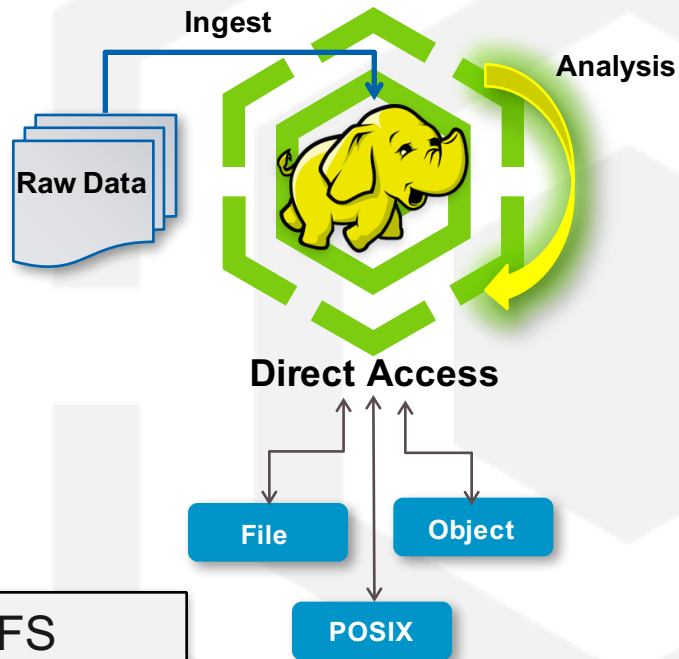
Separate storage systems for ingest, analysis, results

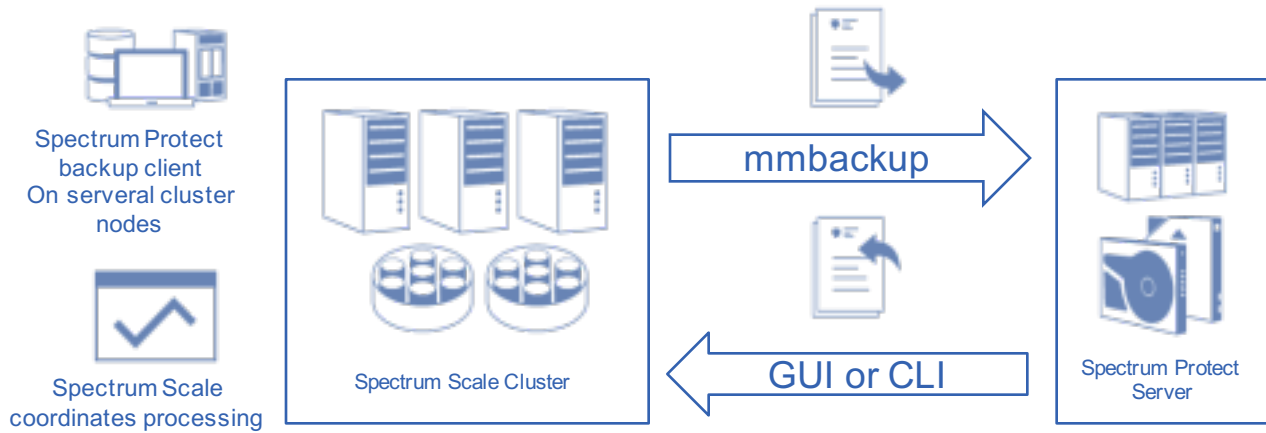
- HDFS requires locality aware storage (namenode)
- Data transfer slows time to results
- Different frameworks & analytics tools use data differently

HDFS Transparency

- Map/Reduce on shared, or shared nothing storage
- No waiting for data transfer between storage systems
- Immediately share results
- Single 'Data Lake' for all applications
- Enterprise data management
- Archive and Analysis in-place

Analyze object and file data without copying into HDFS





- Parallel file system backup processing
- Spectrum Scale mmbackup creates local copy of Spectrum Protect DB and uses policy engine to identify files for backup
- Spectrum Protect backup archive client is used under the hood to backup files to Spectrum Protect Server
- Spectrum Protect restore (CLI or GUI) can be used to restore files

Released in Spectrum Scale 4.2

Client Experience Focus Common interface across Spectrum Portfolio
GUI

Object Storage Unified File and Object
Extended S3 API support

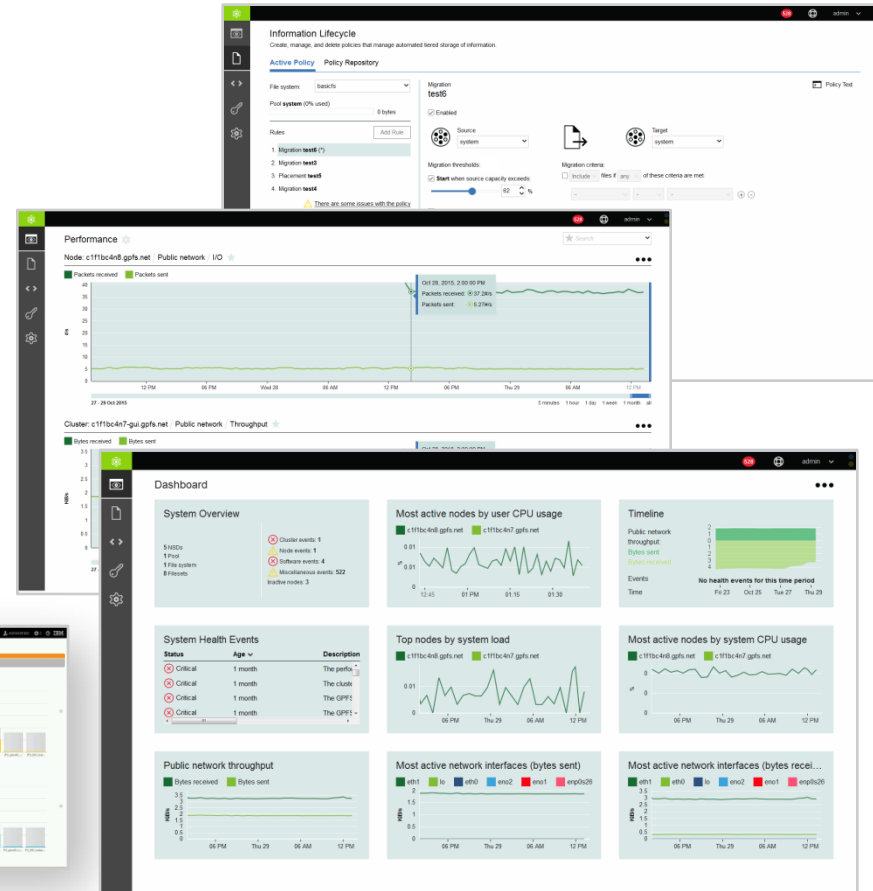
Big Data & Analytics Native Hadoop Support
Ambari Integration

Storage efficiency Compression of Cold data for File & Object

General Quality of Service for File
z Linux support
Sudo wrappers

New Graphical user interface features

- More interactive events timeline overlay with performance metrics.
- Common dashboard for all users
- More directed maintenance procedures
- Sort and filter more data – Example Nodes
- Enhanced drill down.



Speed and simplicity: Performance monitoring highlights

More Configuration
 System health
 Node performance
 Network traffic
 Historical trends



Reduce costs: Compression

Improved storage efficiency

- Typically 2x improvement in storage efficiency

Improved i/o bandwidth

- Read/write compressed data reduces load on storage backend

Improved client side caching

- Caching compressed data increases apparent cache size

Compression is controlled per file

- By administrator defined policy rules



Vision

Which files to compress

When to compress the file data

How to compress the file data

Native Encryption and Secure Erase (new in 4.2.1)

Easier key server configuration with mmkeyserv

- Configures key server
- Provides key and RKMID information for configuration (creating policy)

Example

1. Install ISKLM.
2. Configure NIST & FIPS in Spectrum Scale and ISKLM.
3. Use mmkeyserv command to add/show/delete ISKLM key server(s), tenant(s),
4. encryption key(s) and client(s).
5. Setup encryption policy.



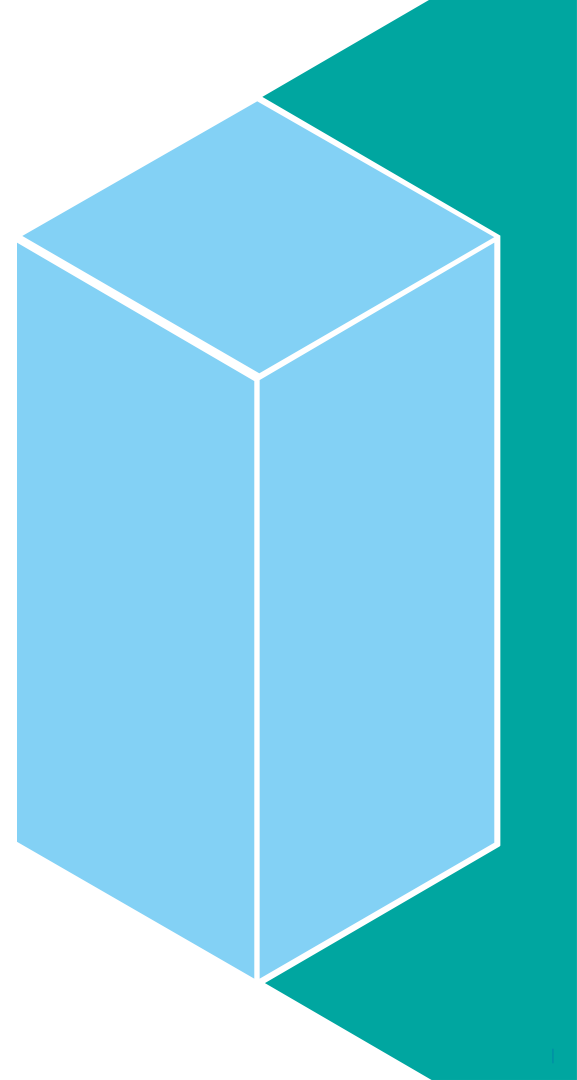
Quality of Service

Spectrum Scale needed a way to control performance of competing tasks:

Restripe, backup, policy scan/ILM/HSM, rcopy and other maintenance tasks – *versus*

Real Work: near-real-time decision support, datacollection and crunching

Priorities 2016




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Customer Feedback




"I want meaningful alerts that don't cause alert fatigue. You can't tell the difference between a client leaving a cluster and a quorum node leaving a cluster."



"What is going on with my GPFS system?"

"This is an art that you learn from experience."

"One of the things that's really lacking in GPFS is constant monitoring."
"There are tens of thousands of components that could break at any given time."



"If we can't monitor something, we can't roll it out."

"Our ops team is looking at dashboards all day. If something doesn't flash in red or come up on their monitoring console, they're not going to see it."

"What I really need is to be able to track down the rogue user who is bogging down the entire system."

"When I come in to work each morning, give me a dashboard that surveys the entire Infrastructure landscape and tells me instantly if my day is going to be great or if it is going to pieces."

2016 Development Priorities

Every year we define a set of goals

- Based on client feedback and market opportunity
- Target is to achieve them within the year



Sponsor User
Interviews



Input from PM
and Field Team



Sponsor User
Observation



PMR
Analysis

Focus areas

- Problem determination
- Documentation
- Security
- Defect backlog

Functional enhancements

- Improvements for Big Data
- More flexibility for Spectrum Scale RAID

Hills – Problem Determination

1

An IT administrator who monitors Spectrum Scale can be made aware of the health of his Spectrum Scale components in one cluster, from a single place.

2

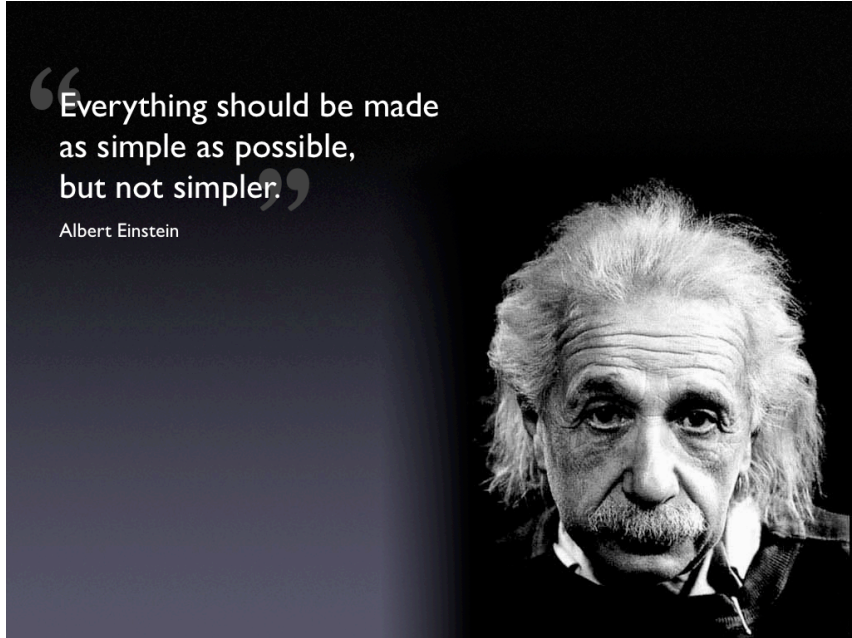
An IT Administrator, can perform self-service problem determination by utilizing provided guidance or automated solutions to problems, without contacting IBM Support.

3

An IT Administrator, can pre-check/check Spectrum Scale and its operating environment to avoid potential problems after initial installation or when changes are made, from a single tool.

Today more than 550 tuning Parameters ...

Tomorrow well, fewer



Simplicity

- Simplicity replaces many parameters by a few aggregated parameters which enable an average skilled user to tune Spectrum Scale for the most common workloads
- Simplicity is problem prevention

Security Work 2016

Sudo wrapper / no root ssh

- Make GUI functional

File encryption (on rest)

- Ease of use improvements in the configuration of SKLM
- Support for the Vormetric key server
- File encryption performance (whitepaper)

Authentication

- GUI admin user can authenticate via external AD or LDAP server (delivered with 4.2.0-1)
- External Keystone SSL support for object

Miscellaneous

- Spectrum Scale security best practices (whitepaper)
- Multi-region object deployment with a highly available keystone service (whitepaper)

Open Betas and Evaluation Virtual Machine

- DeveloperWorks
<https://www.ibm.com/developerworks/servicemanagement/tc/gpfs/evaluate.html>
- IBM Spectrum Scale Trial VM
- IBM Spectrum Scale transparent cloud tiering
- IBM Spectrum Scale Object Metadata Search Open Beta
- IBM Spectrum Scale GUI Open Beta

IBM Spectrum Scale Trial VM

This Trial VM offers fully pre-configured IBM Spectrum Scale instance in a virtual machine based on IBM Spectrum Scale 4.2 GA version. The download bundle includes the virtual image and the requisite guides (Quick Start guide, Explore guide and Advanced guide) allowing you to try the key features in minutes. Use the Quick Start guide for installation instructions. The Explore guide provides step-by-step instructions to try our unified file & Object as well as GUI functionality.

Use [IBM Spectrum Scale Forum](#) or mail to scale@us.ibm.com to ask questions and to give your feedback.

| Date | Type | Description | Download |
|-------------|------------|---|--------------------------|
| 14 Jan 2016 | Evaluation | VM with pre-configured IBM Spectrum Scale | Download |

Spectrum Scale RAID

New diagnostic features

`gssinstallcheck`

Performance Enhancements

Elastic Storage Server



Spectrum Scale RAID



JBODs










Overview of all File Storage Systems



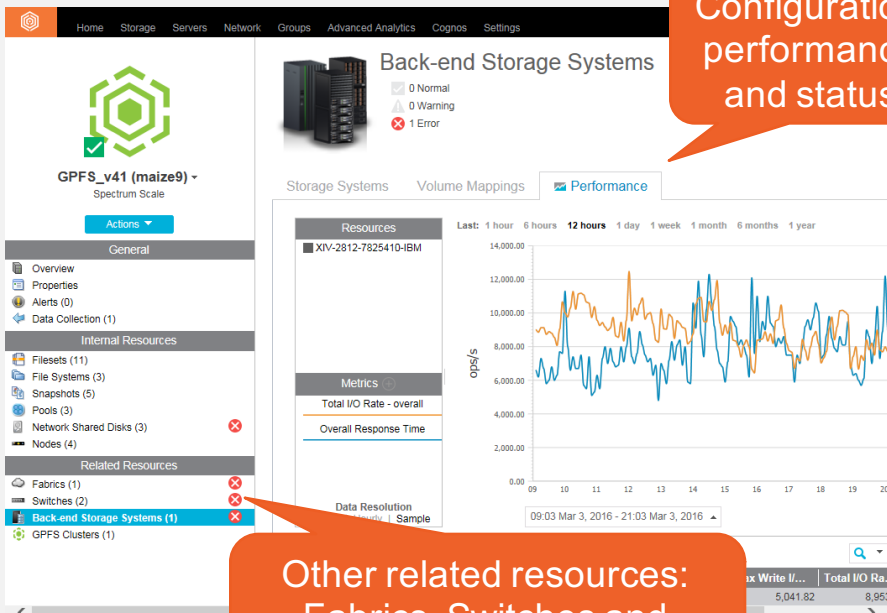
File Storage Systems

- ✔ 6 Normal
- ⚠ 0 Warning
- ✖ 3 Error

Storage Systems
✖ Alerts
Tasks
📊 Performance

| Name | Condition | Location | Probe Status | Performanc... | File System Capacity (%) | Snapshot Space (GiB) | Disks | Type | IP Address | Version |
|---|---|----------|---|--|--------------------------|----------------------|-------|----------------------|-------------|--------------|
|  GPFS_v41 (maize9) | ✖ Error | | ✔ Successful | ⏸ Disabled | 44% | 1.93 | 3 | Spectrum Scale | 9.11.92.75 | 4.1.0.0 |
|  GPFS_v411 (cupcake5) | ✖ Error | | ✔ Successful | ⏸ Disabled | 3% | 0.00 | 1 | Spectrum Scale | 9.11.92.251 | 4.1.1.0 |
|  Storwize V7000-2076-IFS-ballis... | ✖ Error | | ✔ Successful | ▶ Running | 14% | 0.00 | 38 | V7000 Unified - 2073 | 9.11.92.162 | 1.5.1.2-1 |
|  Cluster2 (rye5) | ✔ Normal | | ✔ Successful | ⏸ Disabled | 29% | 0.00 | 5 | Spectrum Scale | 9.11.91.232 | 4.1.0.0 |
|  GPFS_v42 (pear) | ✔ Normal | | ✔ Successful | ▶ Running | 33% | 1.07 | 3 | Spectrum Scale | 9.11.123.80 | 4.2.0.0 |
|  Object (hops2) | ✔ Normal | | ✖ Failed | ▶ Running | 29% | 3.46 | 7 | Spectrum Scale | 9.11.92.101 | 4.1.1.0 |
|  Object2 (rice3) | ✔ Normal | Tucson | ✔ Successful | ▶ Running | 19% | 0.00 | 1 | Spectrum Scale | 9.11.91.97 | 4.1.1.0 |
|  tpcsonas3a.storage.tucson.ibm.... | ✔ Normal | | ✔ Successful | | 0% | 0.00 | 6 | SONAS | 9.11.92.174 | 1.5.1.0-10 |
|  zinc | ✔ Normal | Tucson | ▶ Running | ⏸ Disabled | 35% | 0.00 | 5 | N3700 | 9.11.98.62 | Data ONTA... |

SAN-attached storage troubleshooting



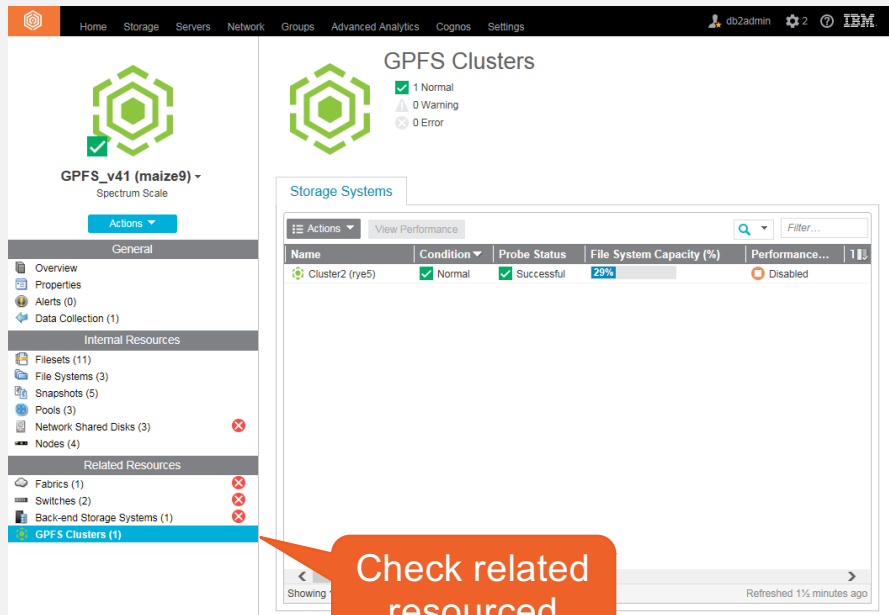
Configuration, performance and status

Other related resources: Fabrics, Switches and Storage Systems

With Spectrum Control

- A storage team can start from a node or file system and trace performance through the fabric to the SAN attached storage.

Multi-cluster environments



The screenshot displays the IBM Spectrum Control interface. The main content area shows 'GPFS Clusters' with a status summary: 1 Normal, 0 Warning, and 0 Error. Below this is a 'Storage Systems' table with the following data:

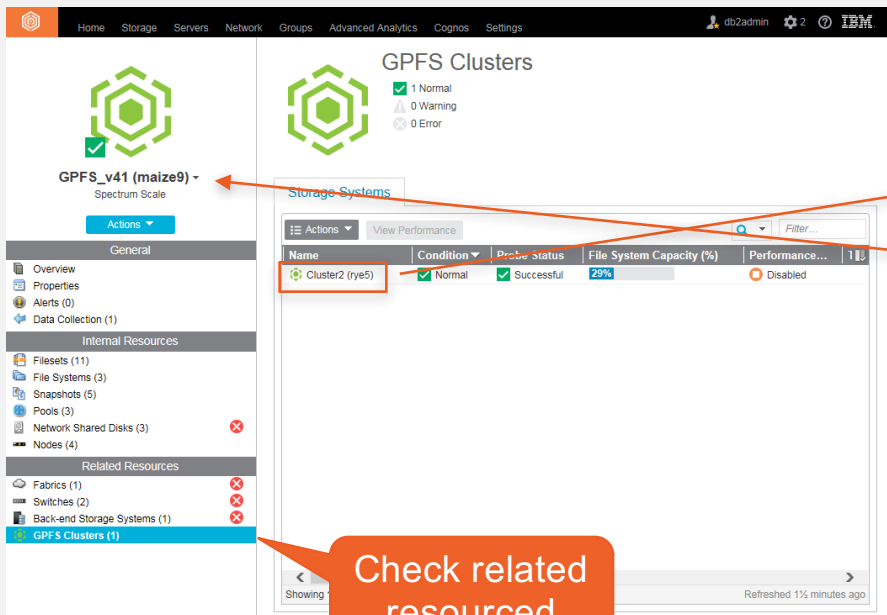
| Name | Condition | Probe Status | File System Capacity (%) | Performance... |
|-----------------|-----------|--------------|--------------------------|----------------|
| Cluster2 (rye5) | Normal | Successful | 29% | Disabled |

In the left sidebar, the 'GPFS Clusters (1)' link is highlighted in blue. An orange callout bubble with the text 'Check related resourced' points to this link.

With Spectrum Control

Storage teams can see their entire Spectrum Scale environment at a glance, easily comparing capacity and workloads across multiple clusters.

Multi-cluster environments II



GPFS Clusters

- 1 Normal
- 0 Warning
- 0 Error

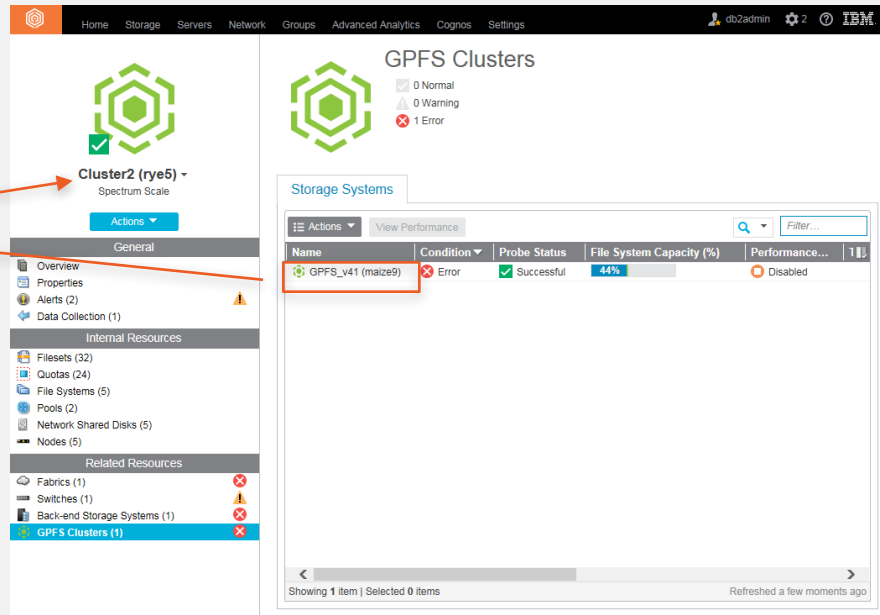
GPFS_v41 (maize9) - Spectrum Scale

Cluster2 (rye5) - Spectrum Scale

| Name | Condition | Probe Status | File System Capacity (%) | Performance... |
|-----------------|-----------|--------------|--------------------------|----------------|
| Cluster2 (rye5) | Normal | Successful | 29% | Disabled |

Showing 1 item | Selected 0 items | Refreshed 1 1/2 minutes ago

Check related resourced



GPFS Clusters

- 0 Normal
- 0 Warning
- 1 Error

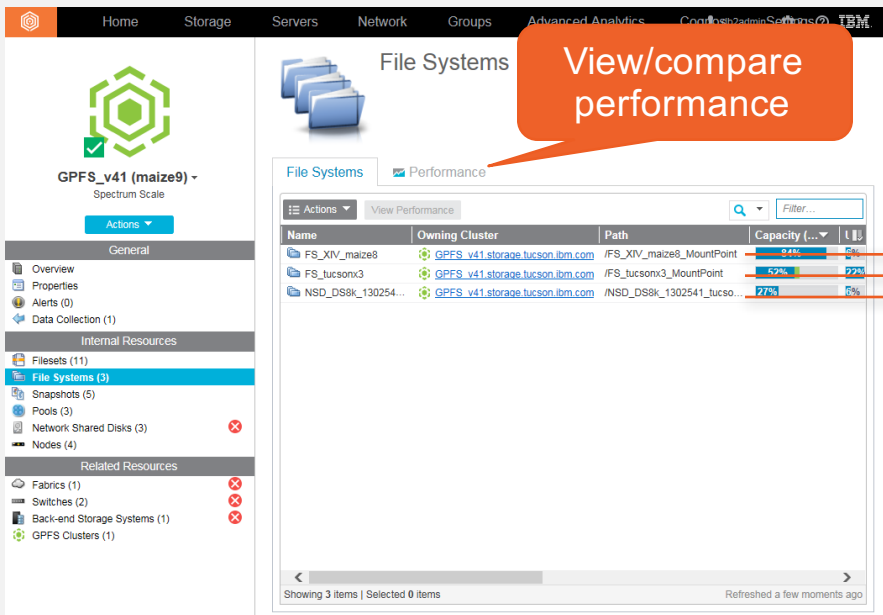
Cluster2 (rye5) - Spectrum Scale

GPFS_v41 (maize9) - Spectrum Scale

| Name | Condition | Probe Status | File System Capacity (%) | Performance... |
|-------------------|-----------|--------------|--------------------------|----------------|
| GPFS_v41 (maize9) | Error | Successful | 44% | Disabled |

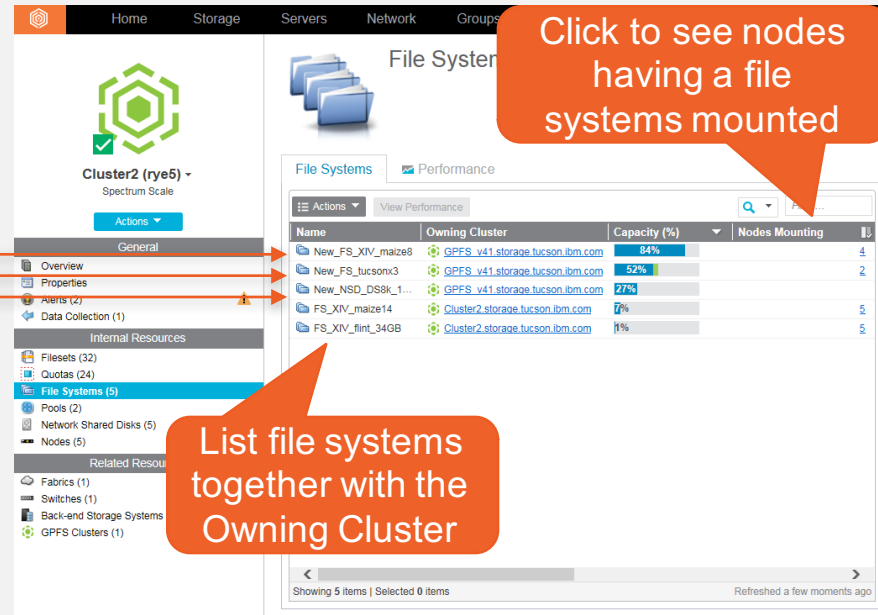
Showing 1 item | Selected 0 items | Refreshed a few moments ago

Multi-cluster environments: Cross-Cluster mounts



View/compare performance

| Name | Owning Cluster | Path | Capacity (%) |
|--------------------|---------------------------------|----------------------------|--------------|
| FS_XIV_maize8 | GPFS_v41.storage.tucson.ibm.com | /FS_XIV_maize8_MountPoint | 84% |
| FS_tucson3 | GPFS_v41.storage.tucson.ibm.com | /FS_tucson3_MountPoint | 52% |
| NSD_DS8k_130254... | GPFS_v41.storage.tucson.ibm.com | /NSD_DS8k_1302541_tucso... | 27% |



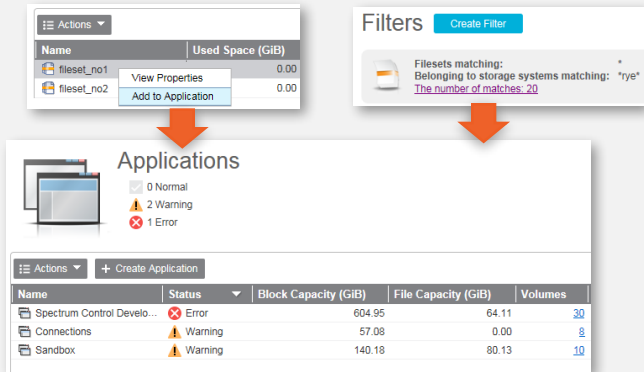
Click to see nodes having a file systems mounted

List file systems together with the Owning Cluster

| Name | Owning Cluster | Capacity (%) | Nodes Mounting |
|-------------------|---------------------------------|--------------|----------------|
| New_FS_XIV_maize8 | GPFS_v41.storage.tucson.ibm.com | 84% | 1 |
| New_FS_tucson3 | GPFS_v41.storage.tucson.ibm.com | 52% | 2 |
| New_NSd_DS8k_1... | GPFS_v41.storage.tucson.ibm.com | 27% | 1 |
| FS_XIV_maize14 | Cluster2.storage.tucson.ibm.com | 7% | 5 |
| FS_XIV_fint_34GB | Cluster2.storage.tucson.ibm.com | 1% | 5 |

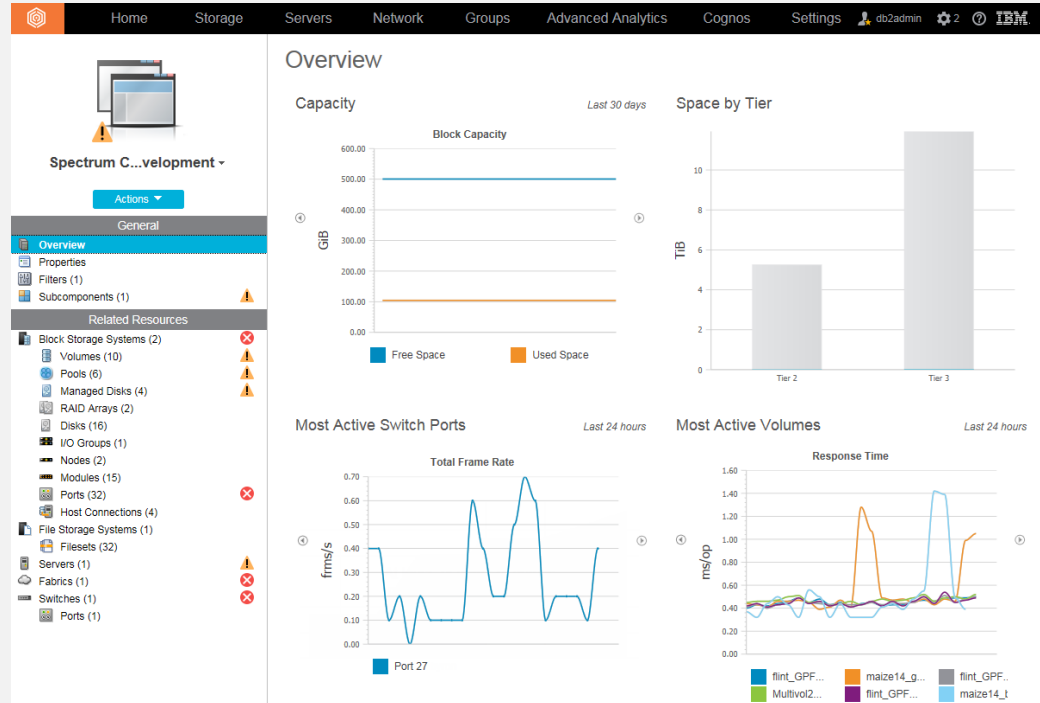
Application oriented monitoring

With Spectrum Control - A Spectrum Scale admin defines which resources belong to an application. From a list of applications (or departments) the admin can open a panel that shows all the information in a single place.



The screenshot shows two panels. The top panel is for configuring applications, with a table of filesets and their used space. The bottom panel is the 'Applications' overview, showing a summary of application status and a table of application details.

| Name | Status | Block Capacity (GiB) | File Capacity (GiB) | Volumes |
|----------------------------|---------|----------------------|---------------------|---------|
| Spectrum Control Develo... | Error | 604.95 | 64.11 | 30 |
| Connections | Warning | 57.08 | 0.00 | 10 |
| Sandbox | Warning | 140.18 | 80.13 | 10 |



The screenshot shows the 'Overview' dashboard for an application. It includes a navigation menu on the left, a 'Capacity' section with a line chart for 'Block Capacity' (Free and Used Space), a 'Space by Tier' bar chart, 'Most Active Switch Ports' and 'Most Active Volumes' line charts, and a 'Related Resources' tree view.

Block Capacity (Last 30 days)

| Space Type | Capacity (GiB) |
|------------|----------------|
| Free Space | ~500.00 |
| Used Space | ~100.00 |

Space by Tier (Last 30 days)

| Tier | Capacity (TiB) |
|--------|----------------|
| Tier 2 | ~5.0 |
| Tier 3 | ~11.0 |

Most Active Switch Ports (Last 24 hours)

Most Active Volumes (Last 24 hours)

Related Resources


- Block Storage Systems (2)
 - Volumes (10)
 - Pools (6)
 - Managed Disks (4)
 - RAID Arrays (2)
 - Disks (16)
 - I/O Groups (1)
 - Nodes (2)
 - Modules (15)
 - Ports (32)
 - Host Connections (4)
- File Storage Systems (1)
- Filesets (32)
- Servers (1)
- Fabrics (1)
- Switches (1)
- Ports (1)

Snapshot backup of Applications

With Spectrum Control - A Spectrum Protect Snapshot can be used to integrate application consistent backups, offloading the backup to tape, and maintain a backup history that's available in Spectrum Control.








Notes:

- Minimum Spectrum Protect Version 4.1.1.2 (1Q15)
- Minimum Spectrum Protect Version 4.1.4 (1Q16) with offload backup to Spectrum Protect (aka TSM) [link](#)
- Minimum Spectrum Scale Version: 4.1.0.5



Snapshots

Actions ▾
Filter...

| Name | Creation Time | File System | Fileset | Size (GiB) | |
|--|------------------------|---|--|------------|--|
|  Filesystem[GPFS2]-SNAP[2]@GMT-2015-... | Nov 2, 2015, 22:41:19 |  gpfs2 | | 1.07 | |
|  Filesystem[GPFS2]-SNAP[1]@GMT-2015-... | Nov 2, 2015, 21:46:52 |  gpfs2 | | 0.00 | |
|  Snapshot1@GMT-2015.10.30-15.25.51 | Oct 30, 2015, 19:26:00 |  gpfs1 |  gpfs1 Fileset1 | 0.00 | |

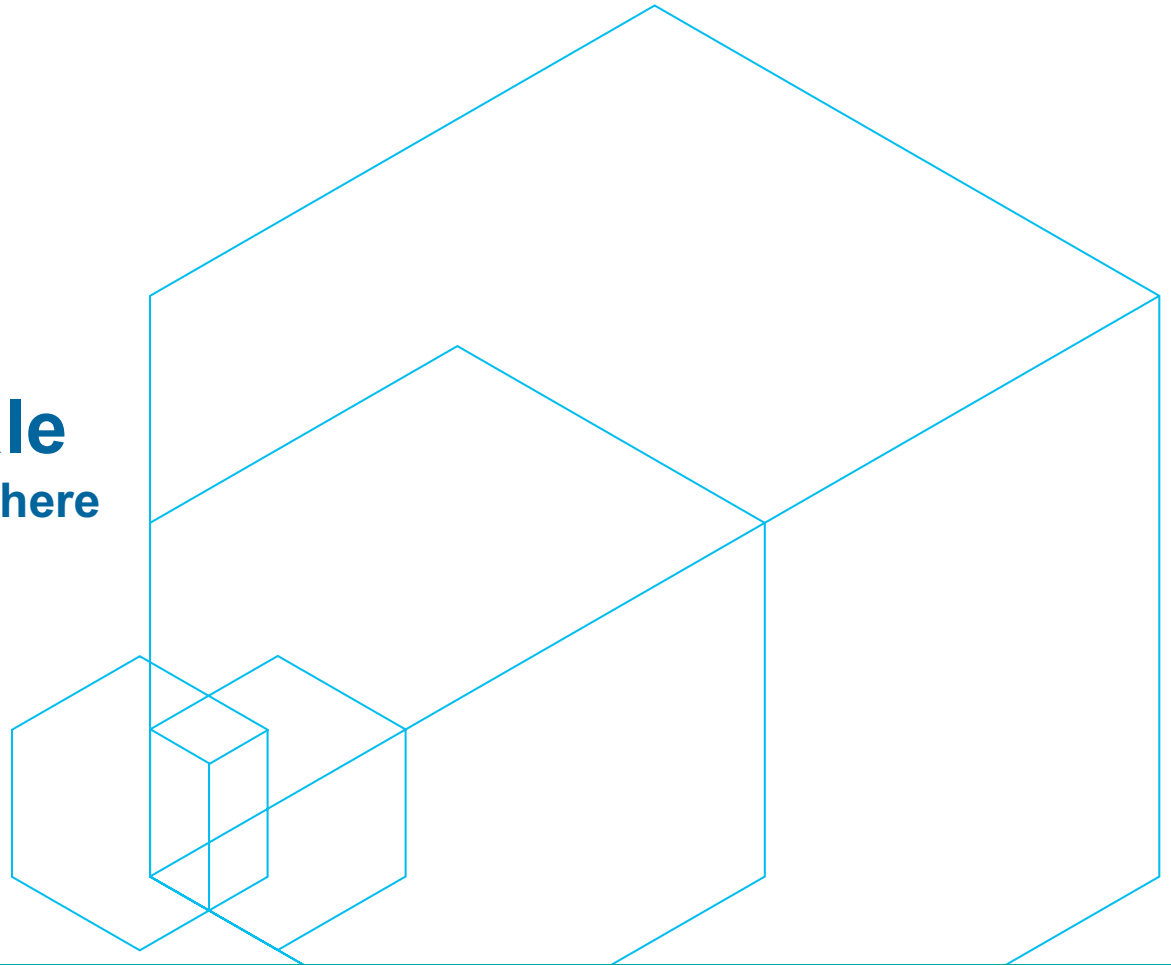
Showing 3 items | Selected 0 items
Refreshed a few moments ago

IBM Spectrum Scale

Store **Everywhere**. Run **Anywhere**



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