

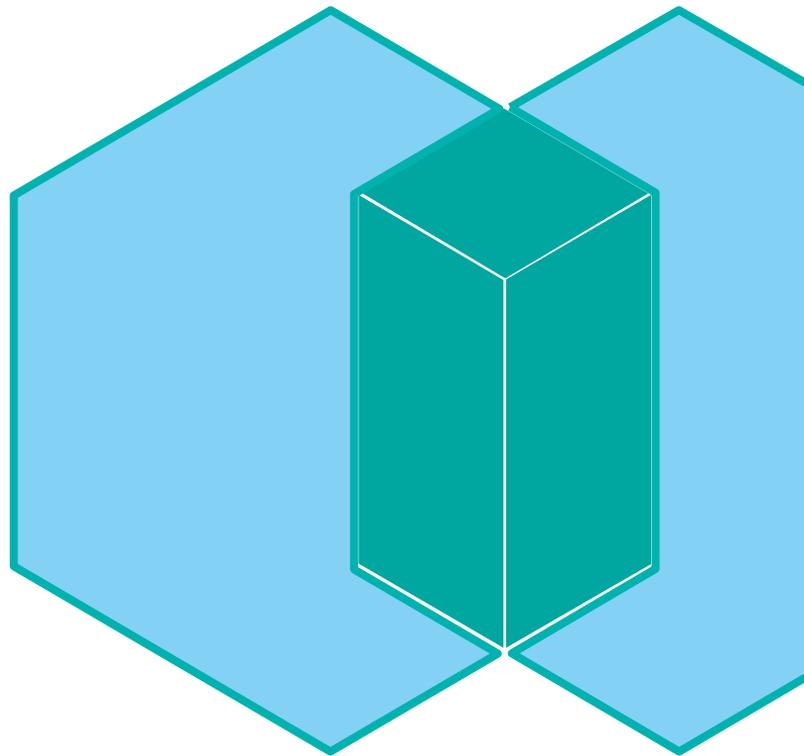


# IBM Spectrum Scale

– New and Future –

**Spectrum Scale User Group Meeting 2016**

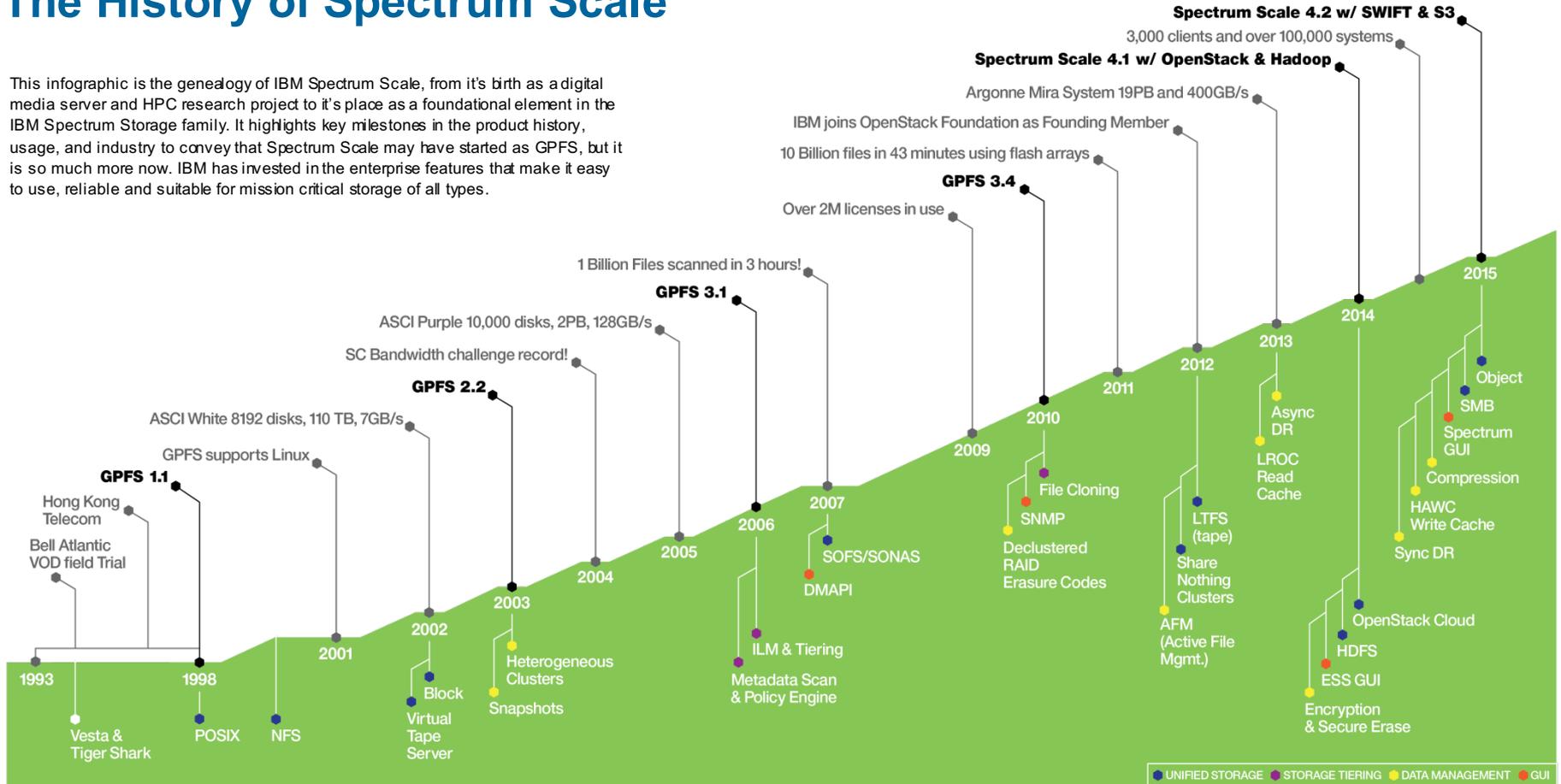
**Argonne National Labs, June 10, 2016 – Scott Fadden**



# *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.



# Store everywhere. Run anywhere.

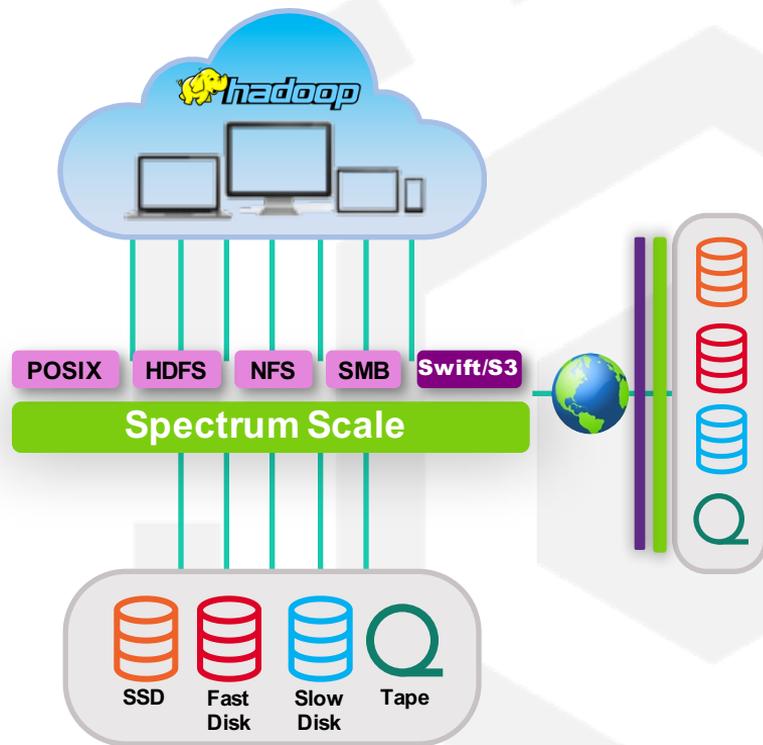
*Remove data-related bottlenecks*

## 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

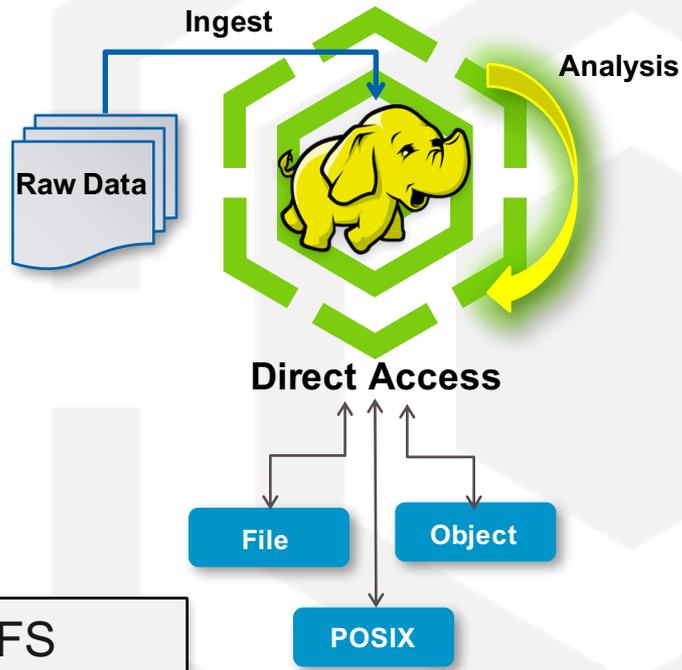
Separate storage systems for ingest, analysis, results

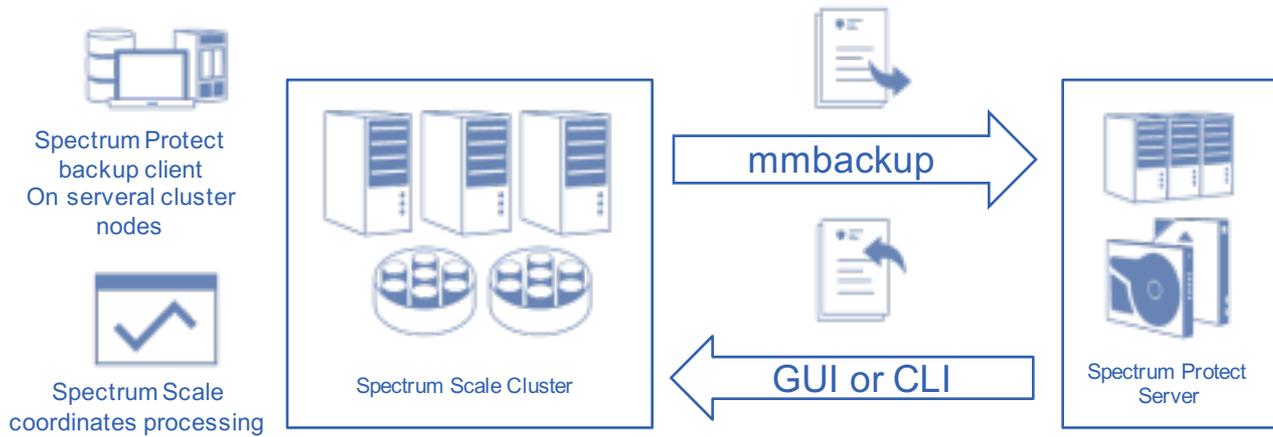
- HDFS requires locality aware storage (namenode)
- Data transfer slows time to results
- Different frameworks & analytics tools use data differently

## 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

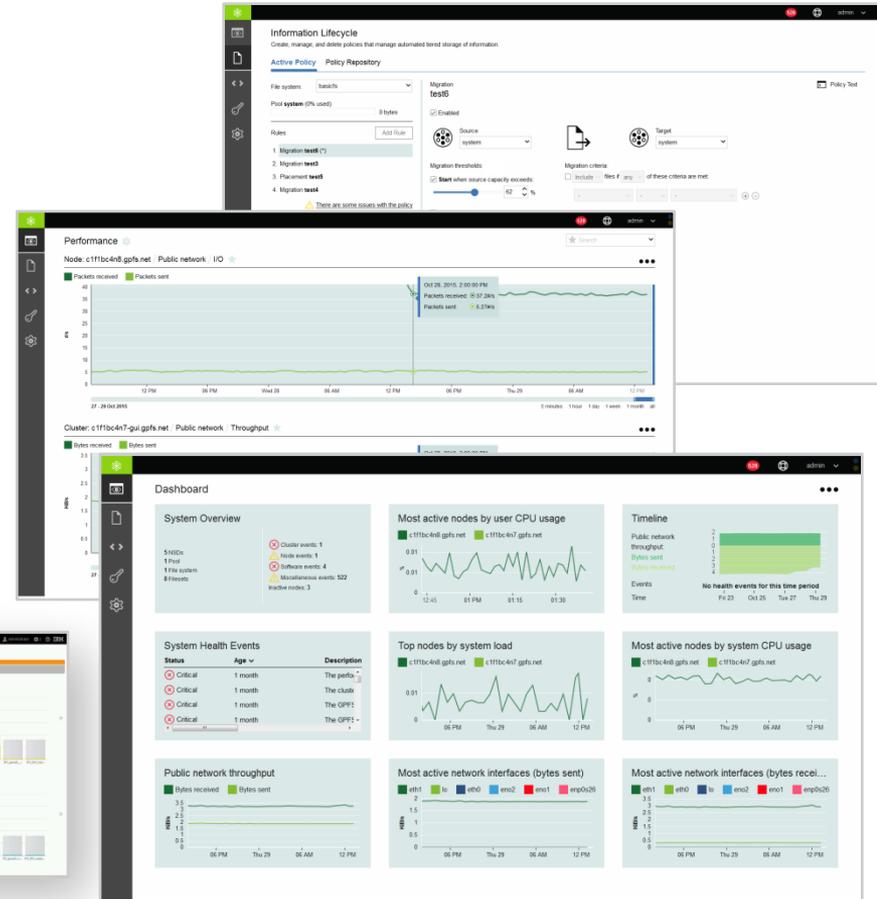
**Big Data & Analytics** Native Hadoop Support  
Ambari Integration

**Storage efficiency** Compression of Cold data for File & Object

**General** Quality of Service for File  
z Linux support  
Sudo wrappers

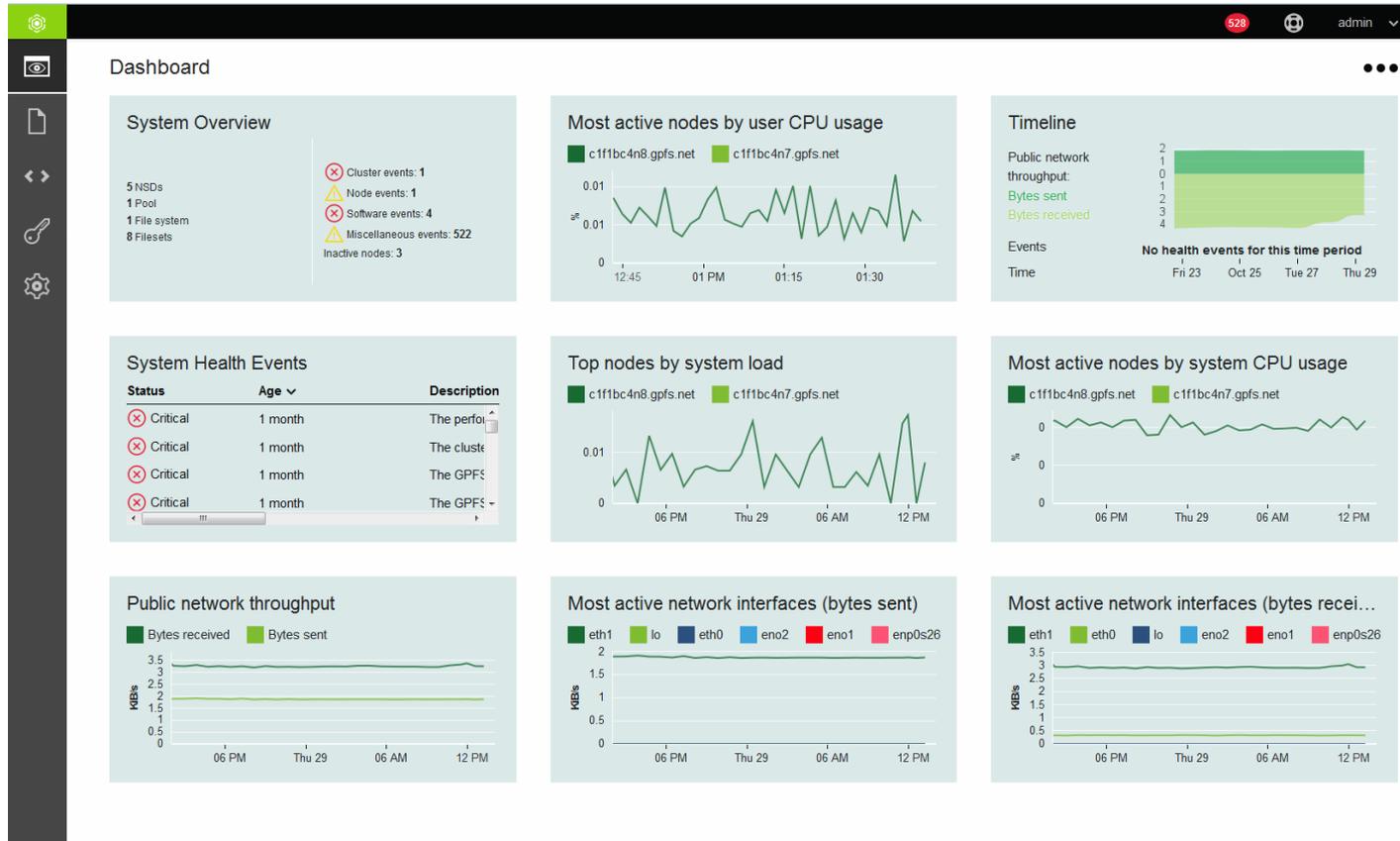
# New Graphical user interface features

- 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.



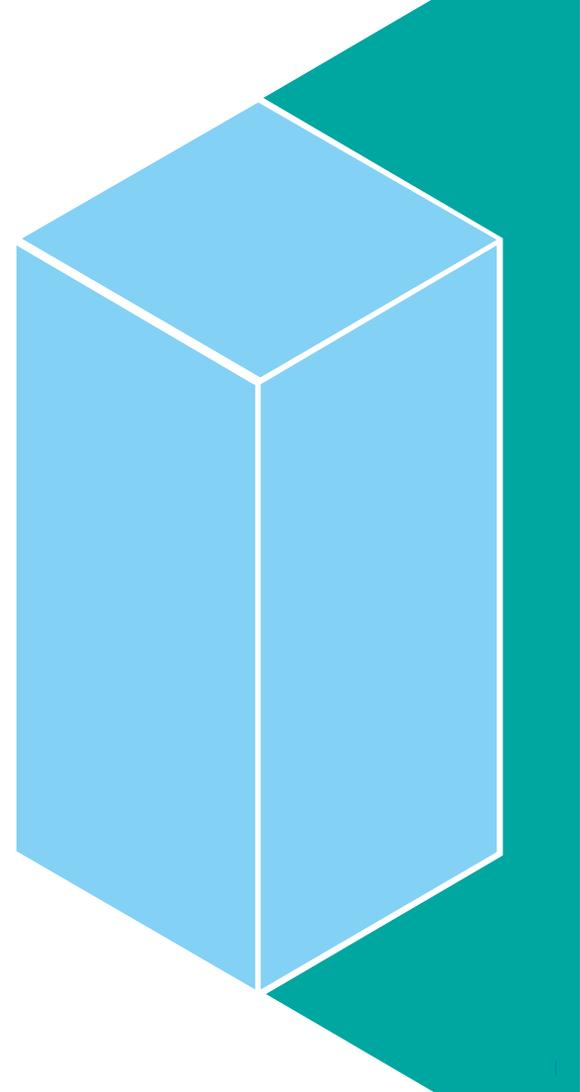
## Quality of Service

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

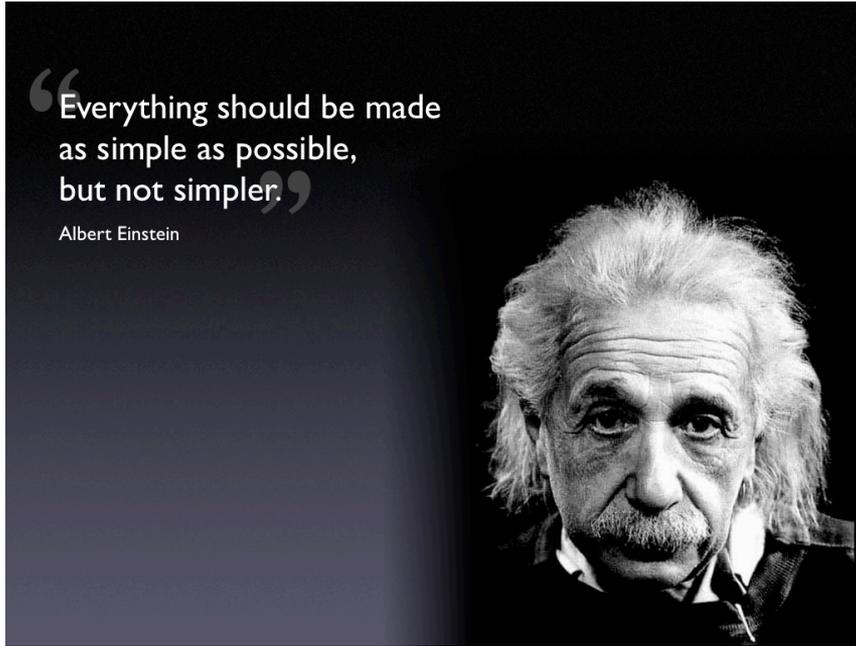
An IT Administrator, can perform self-service problem determination by utilizing provided guidance or automated solutions to problems, without contacting IBM Support.

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](mailto: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	<a href="#">Download</a>

# 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

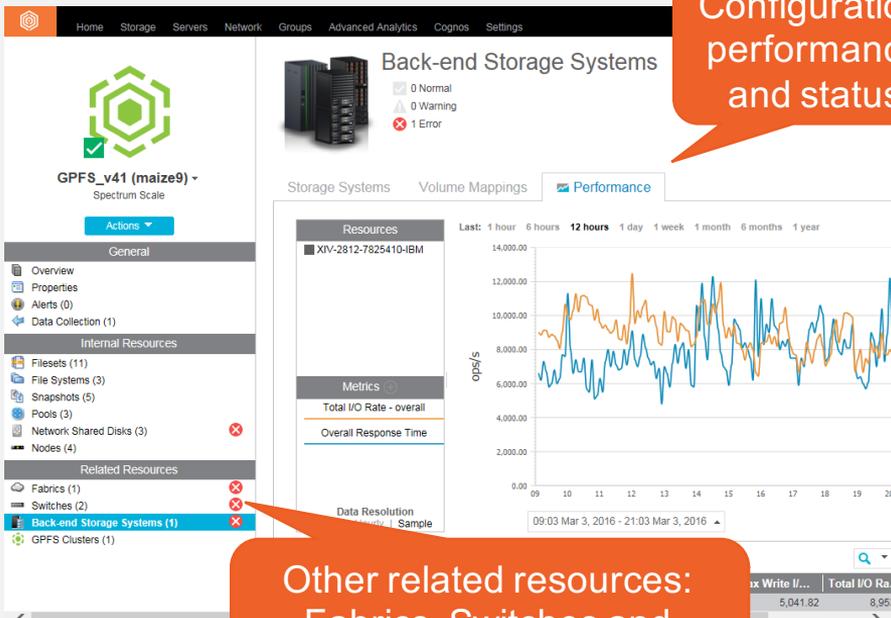
- ✔ 6 Normal
- ⚠ 0 Warning
- ✖ 3 Error

Storage Systems ✖ Alerts Tasks Performance

Actions + Add Storage System View Performance

Name	Condition	Location	Probe Status	Performanc...	File System Capacity (%)	Snapshot Space (GiB)	Disks	Type	IP Address	Version
 GPFS_v41 (maize9)	<span style="color: red;">✖</span> Error		<span style="color: green;">✔</span> Successful	<span style="color: orange;">⏸</span> Disabled	<div style="width: 44%;"><div style="background-color: #007bff; height: 10px;"></div></div> 44%	1.93	3	Spectrum Scale	9.11.92.75	4.1.0.0
 GPFS_v411 (cupcake5)	<span style="color: red;">✖</span> Error		<span style="color: green;">✔</span> Successful	<span style="color: orange;">⏸</span> Disabled	<div style="width: 8%;"><div style="background-color: #007bff; height: 10px;"></div></div> 8%	0.00	1	Spectrum Scale	9.11.92.251	4.1.1.0
 Storwize V7000-2076-IFS-ballis...	<span style="color: red;">✖</span> Error		<span style="color: green;">✔</span> Successful	<span style="color: blue;">▶</span> Running	<div style="width: 14%;"><div style="background-color: #007bff; height: 10px;"></div></div> 14%	0.00	38	V7000 Unified - 2073	9.11.92.162	1.5.1.2-1
 Cluster2 (rye5)	<span style="color: green;">✔</span> Normal		<span style="color: green;">✔</span> Successful	<span style="color: orange;">⏸</span> Disabled	<div style="width: 29%;"><div style="background-color: #007bff; height: 10px;"></div></div> 29%	0.00	5	Spectrum Scale	9.11.91.232	4.1.0.0
 GPFS_v42 (pear)	<span style="color: green;">✔</span> Normal		<span style="color: green;">✔</span> Successful	<span style="color: blue;">▶</span> Running	<div style="width: 33%;"><div style="background-color: #007bff; height: 10px;"></div></div> 33%	1.07	3	Spectrum Scale	9.11.123.80	4.2.0.0
 Object (hops2)	<span style="color: green;">✔</span> Normal		<span style="color: red;">✖</span> Failed	<span style="color: blue;">▶</span> Running	<div style="width: 29%;"><div style="background-color: #007bff; height: 10px;"></div></div> 29%	3.46	7	Spectrum Scale	9.11.92.101	4.1.1.0
 Object2 (rice3)	<span style="color: green;">✔</span> Normal	Tucson	<span style="color: green;">✔</span> Successful	<span style="color: blue;">▶</span> Running	<div style="width: 19%;"><div style="background-color: #007bff; height: 10px;"></div></div> 19%	0.00	1	Spectrum Scale	9.11.91.97	4.1.1.0
 tpcsonas3a.storage.tucson.ibm....	<span style="color: green;">✔</span> Normal		<span style="color: green;">✔</span> Successful		<div style="width: 0%;"><div style="background-color: #007bff; height: 10px;"></div></div> 0%	0.00	6	SONAS	9.11.92.174	1.5.1.0-10
 zinc	<span style="color: green;">✔</span> Normal	Tucson	<span style="color: blue;">▶</span> Running	<span style="color: orange;">⏸</span> Disabled	<div style="width: 35%;"><div style="background-color: #007bff; height: 10px;"></div></div> 35%	0.00	5	N3700	9.11.98.62	Data ONTA...

# SAN-attached storage troubleshooting



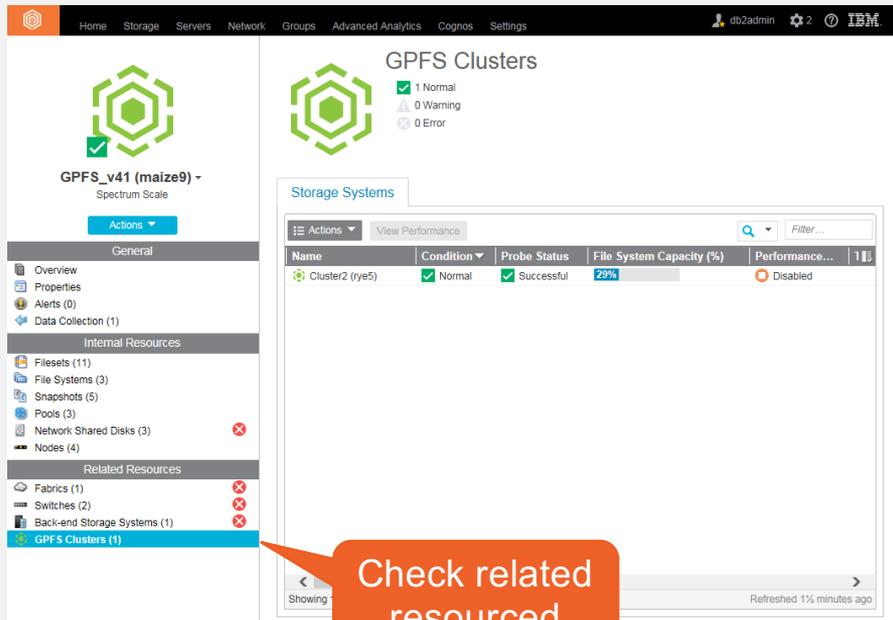
Configuration, performance and status

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 top navigation bar includes Home, Storage, Servers, Network, Groups, Advanced Analytics, Cognos, and Settings. The user is logged in as db2admin. 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:

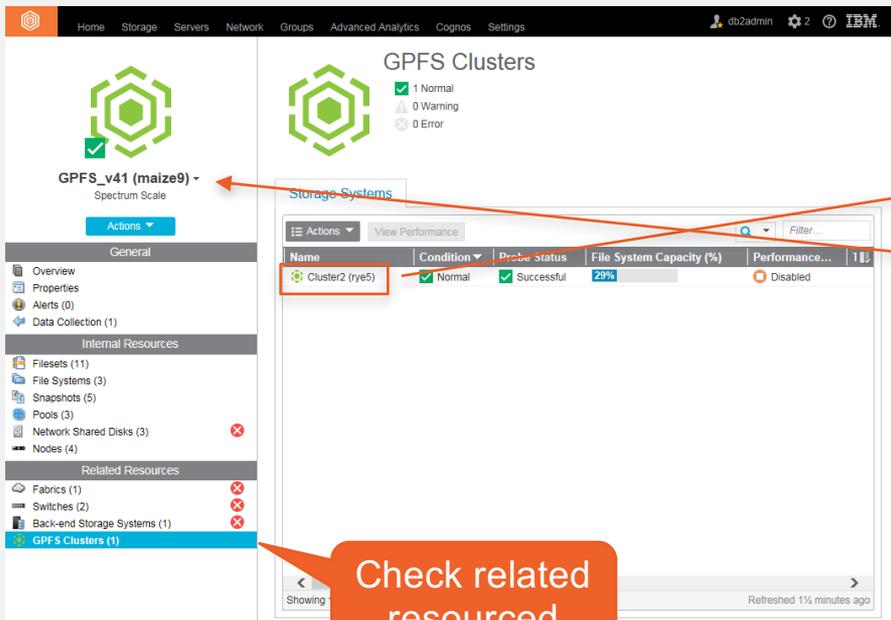
Name	Condition	Probe Status	File System Capacity (%)	Performance...
Cluster2 (rye5)	Normal	Successful	29%	Disabled

The left sidebar contains a navigation menu with sections: General (Overview, Properties, Alerts, Data Collection), Internal Resources (Filesets, File Systems, Snapshots, Pools, Network Shared Disks, Nodes), and Related Resources (Fabrics, Switches, Back-end Storage Systems, GPFS Clusters). 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

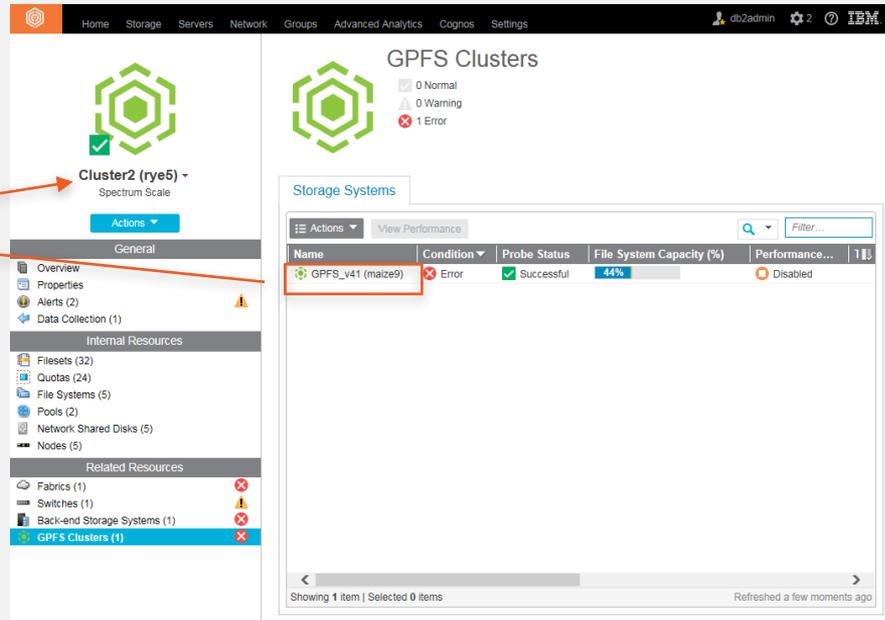
- 1 Normal
- 0 Warning
- 0 Error

**GPFS\_v41 (maize9)** - Spectrum Scale

Storage Systems

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

Check related resourced



GPFS Clusters

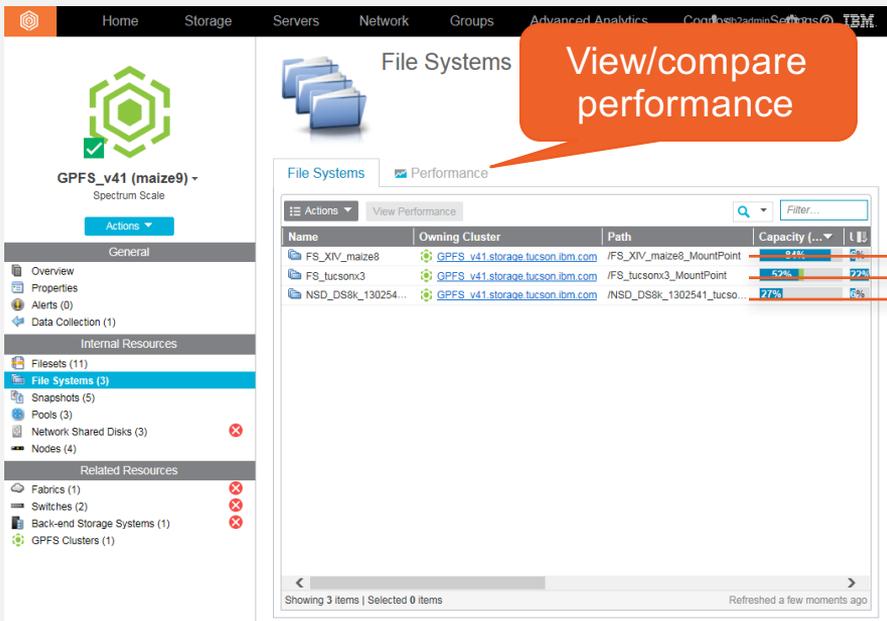
- 0 Normal
- 0 Warning
- 1 Error

**Cluster2 (rye5)** - Spectrum Scale

Storage Systems

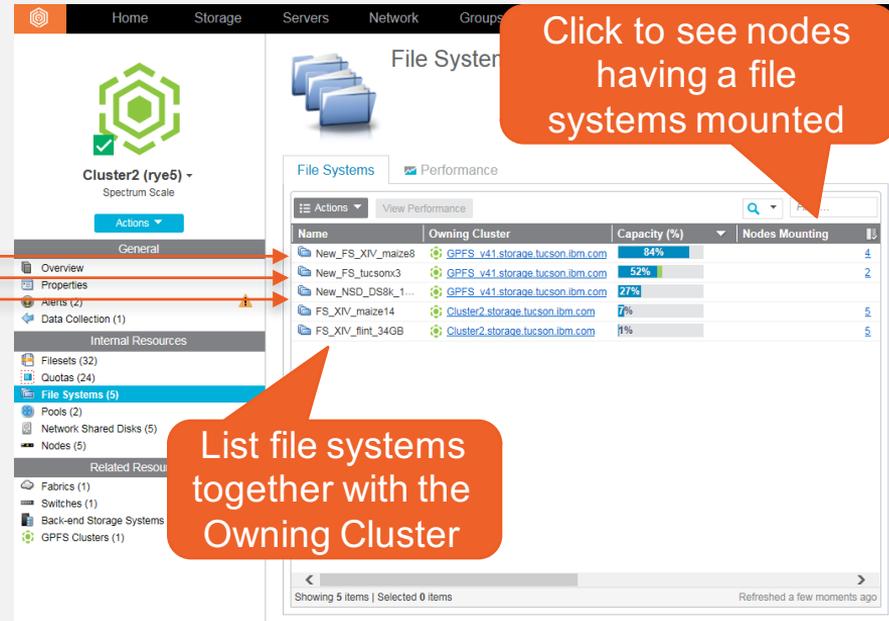
Name	Condition	Probe Status	File System Capacity (%)	Performance...
GPFS_v41 (maize9)	Error	Successful	44%	Disabled

# 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%



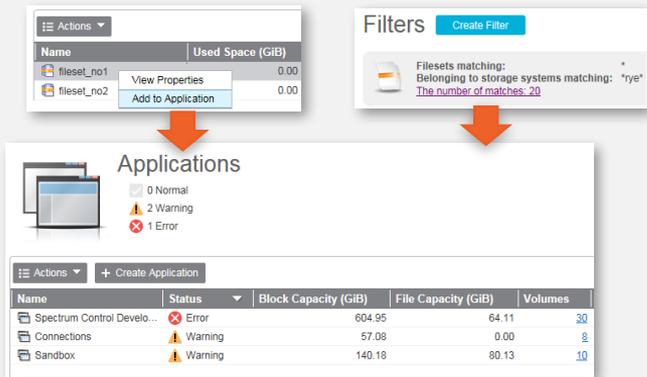
**Click to see nodes having a file systems mounted**

**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.

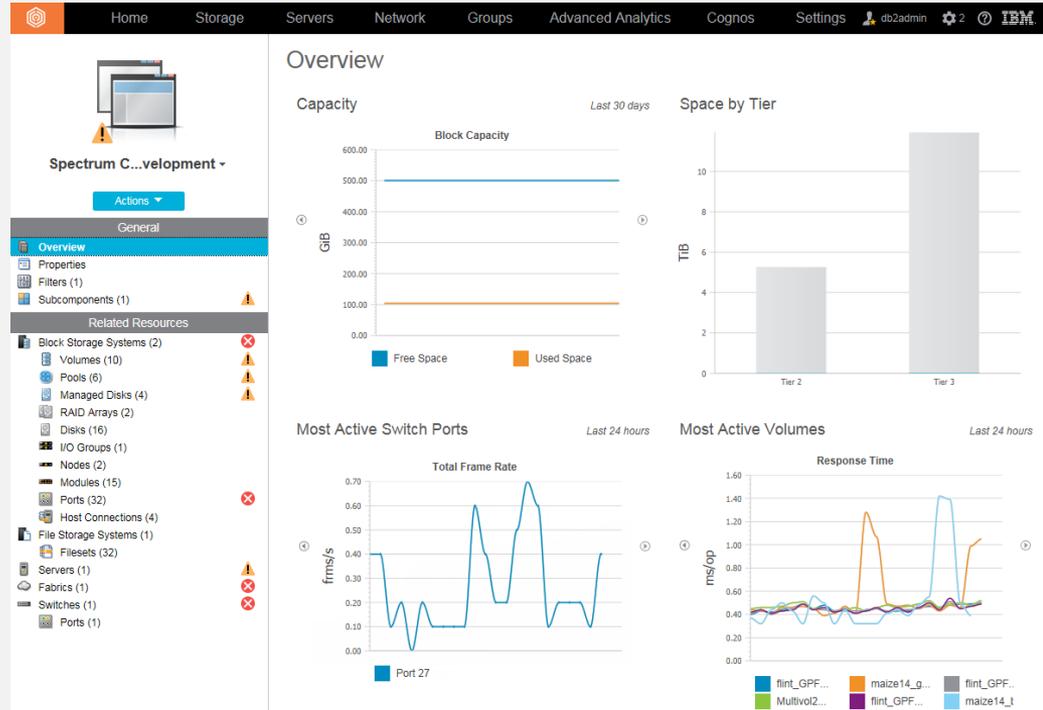


**Applications**

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

**Filters**

Filesets matching: `*rye*`  
 Belonging to storage systems matching: `*rye*`  
 The number of matches: 20



**Overview**

**Capacity** (Last 30 days)

**Block Capacity**

Free Space (blue line), Used Space (orange line)

**Space by Tier**

Tier 2: ~5.5 TiB, Tier 3: ~11.5 TiB

**Most Active Switch Ports** (Last 24 hours)

**Total Frame Rate**

Port 27 (blue line)

**Most Active Volumes** (Last 24 hours)

Response Time (ms/op)

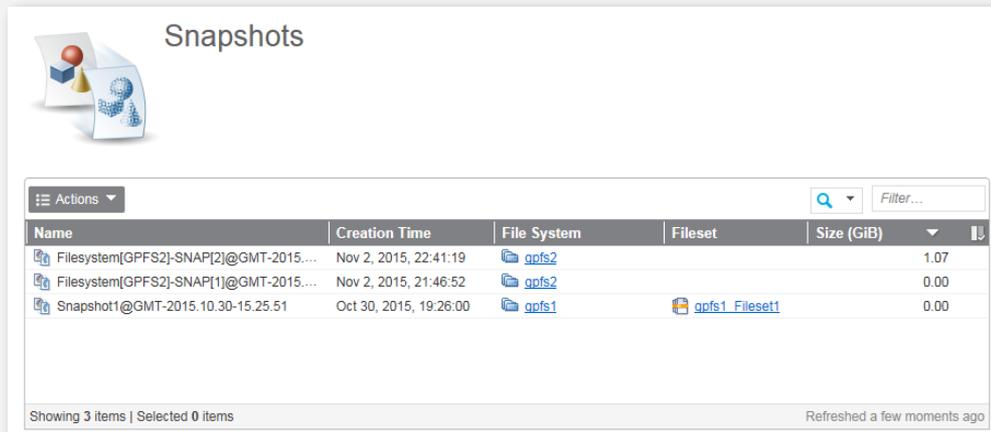
flint\_GPF..., maize14\_g..., flint\_GPF..., Multivol2..., flint\_GPF..., maize14\_t

# 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

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

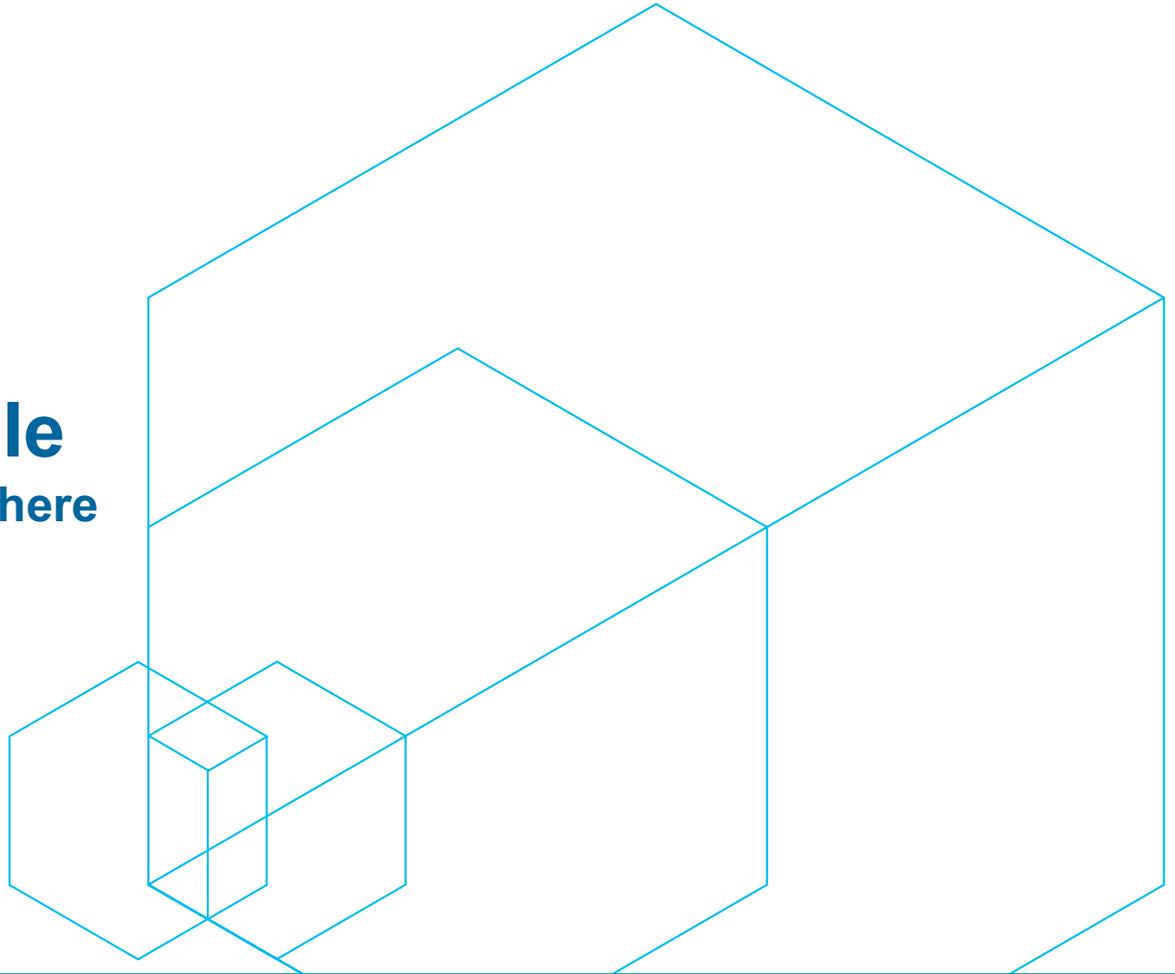
Showing 3 items | Selected 0 items Refreshed a few moments ago

# IBM Spectrum Scale

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



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