Spectrum Protect
&
Spectrum Scale

Grósz Attila
IBM Systems Storage

Tivoli Storage Manager (TSM)
&
General Parallel File System (GPFS)

Grósz Attila
IBM Systems Storage

Protect with Scale

Spectrum Protect és Spectrum Scale mint

HSM (Hierarchical Storage Management) megoldás

ennek egy alternatív megoldása
Spectrum Archive szintén HSM megoldás csak LTFS* -sel

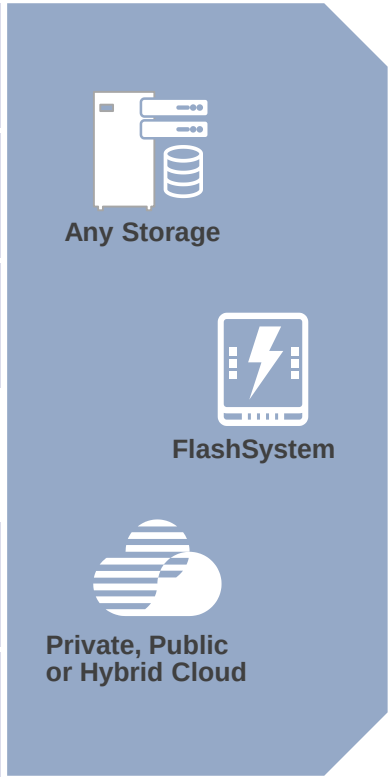
ESS (Elastic Storage Server) & Spectrum Scale mint storage pool

.

** LTFS – Linear Tape File System*

IBM Spectrum Storage Család

IBM Spectrum Control	Tároló- és adat menedzsment, akár **73% -kal alacsonyabb adminisztrációs költségek**
IBM Spectrum Protect	Optimalizált adatvédelem, akár **53% -kal kevesebb mentési költség**
IBM Spectrum Archive	Adatmegőrzés, aktív archivált adatok megtartása **akár 90% -kal kisebb TCO -val**
IBM Spectrum Virtualize	Heterogén Virtualizációs környezet 5x nagyobb adattárolási képességgel
IBM Spectrum Accelerate	Enterprise tárolómegoldás, cloud-ready storage **percek alatt**
IBM Spectrum Scale	Nagy teljesítményű, magasan skálázható **file, object és analitikai** adattároló megoldás



Az érintett termékek köre

IBM Spectrum Control	Tároló- és adat menedzsment, akár **73% -kal alacsonyabb adminisztrációs költségek**
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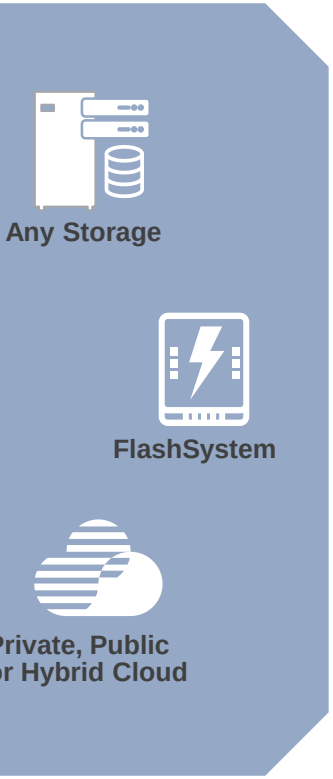


Spectrum Scale

Mi ez?
Mire jó?

...röviden

IBM Spectrum Scale

Nagy teljesítményű, magasan skálázható, párhuzamos, file, object és analítikai adattároló megoldás

Software (File System)

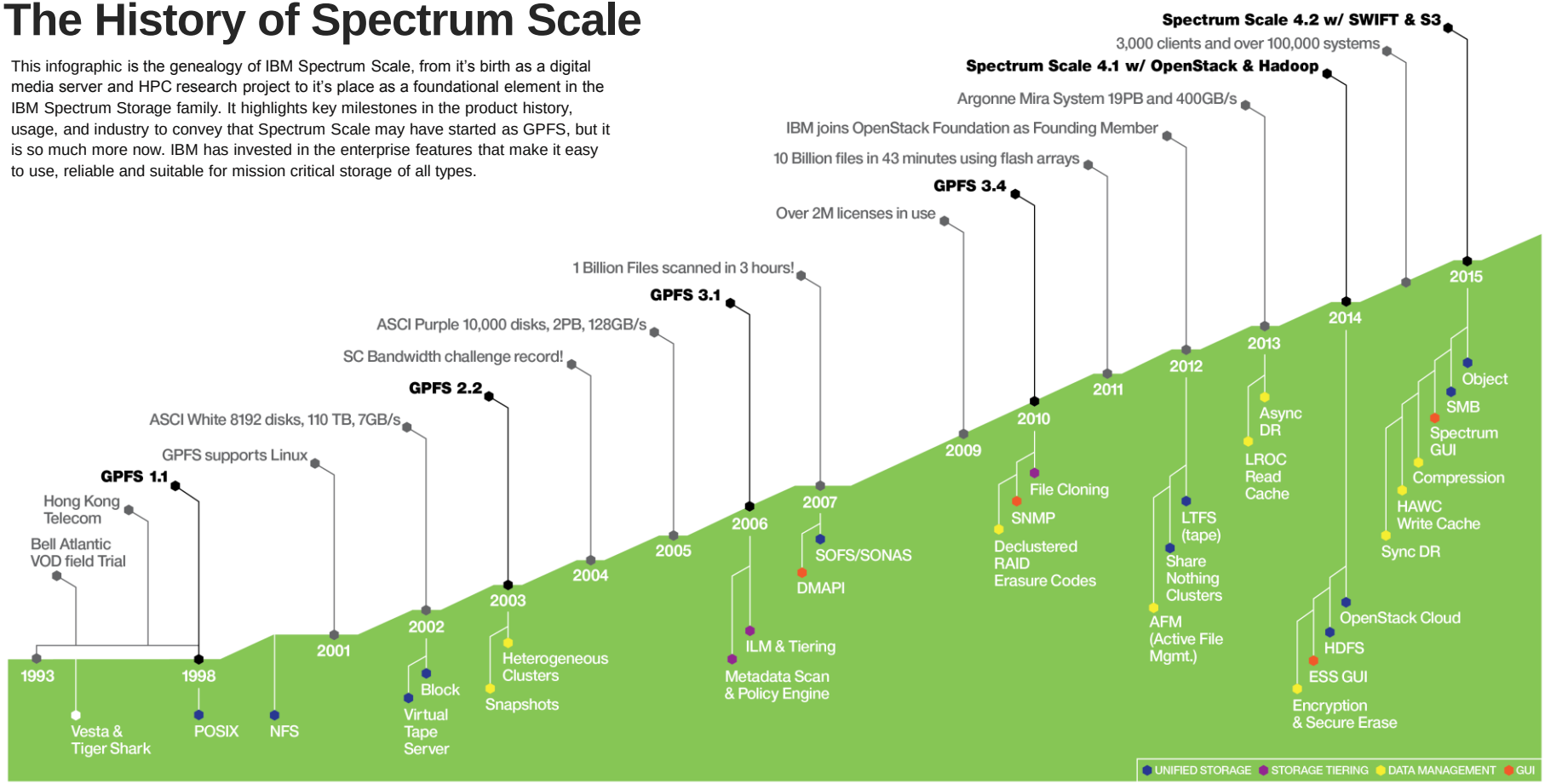
Appliance (ESS)

Cloud (softlayer)

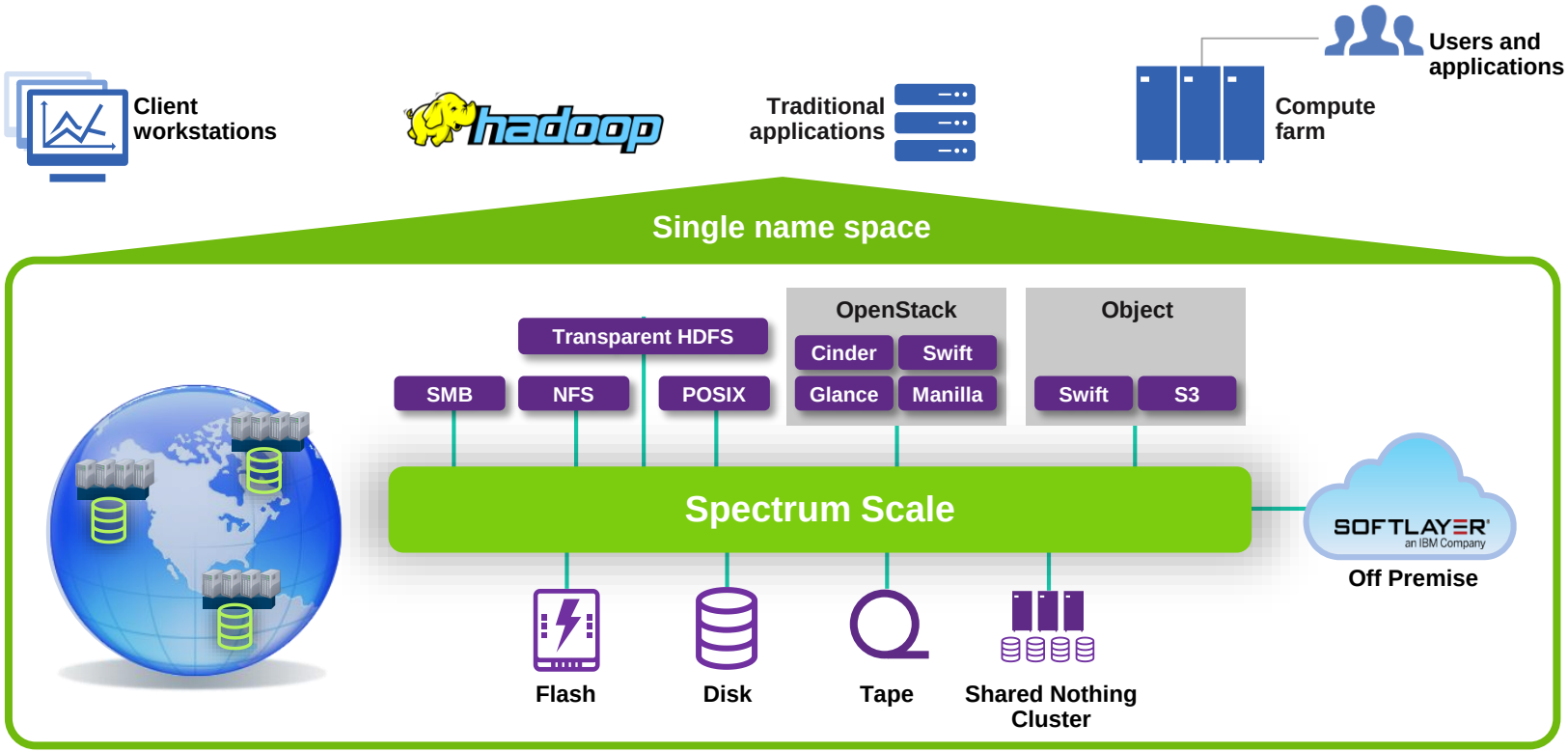
- Clustered File System – univerzális, párhuzamos adatelérés
- Demonstrált 400 GB/s sávszélesség, no hot-spot
- Fejlett adat-disztribúciós funkciók, ILM, HWAC, LROC, QoS
- End-to-end checksum, Spectrum Scale RAID, NIST/FIPS certification

The History of Spectrum Scale

This infographic is the genealogy of IBM Spectrum Scale, from it's birth as a digital media server and HPC research project to it's 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.



Spectrum Scale: Redefining Unified Storage



HSM kétféleképpen

Spectrum Archive
vs.
Spectrum Protect Space Management

HSM implementációk – „Highlevel Architecture”

Application can run on Spectrum Protect NSD client or server nodes.

Supported platforms:
Application on NSD client:
AIX™, xLinux, pLinux, zLinux, Windows®
Application on NSD server:
Spectrum Protect: AIX™, xLinux, zLinux (4Q15)
Spectrum Archive: xLinux

IBM Spectrum Scale

Spectrum Scale NSD clients

Spectrum Scale NSD server

Supported platforms:
AIX™, xLinux, pLinux, zLinux, Windows®

Spectrum Protect for Space Management
Spectrum Protect Backup Archive Client

Supported platforms:
AIX™, xLinux, zLinux (4Q15)

IBM Spectrum Protect

Function:
- Backup, Restore
- Migration, Recall
- SOBAR

Spectrum Protect Server

Supported platforms:
AIX™, xLinux, pLinux, zLinux, HP, Sol, Windows®

Supported storage technologies

Disk, Optical, Tape Library, Object Storage

Both components use the same HSM logic and cannot be operated in one Spectrum Scale cluster

Spectrum Archive Enterprise Edition

Supported platform:
xLinux

IBM Spectrum Archive

Function:
- Migration, Recall

Supported storage medium:
LTFS compatible Tape Library

Igények vs. funkcionalitás

Védelem típusa:			Javasolt megoldás:
Backup			Use Spectrum Protect in combination with Spectrum Scale **mmbackup**. Reason: Spectrum Archive Enterprise Edition does not provide classical backup features like versioning. Furthermore Spectrum Protect backup can‘t be combined with Spectrum Archive on the same file system.
Backup	+	HSM*	Use Spectrum Protect Backup Archive Client in combination with Spectrum Scale mmbackup and Spectrum Protect for Space Management. Reason: Spectrum Protect for Space Management and backup archive client provide a close integration. Spectrum Protect backup can‘t be combined with Spectrum Archive on the same file system.
		HSM*	See comparison of functions on next slides. Reason: Both products integrate with Spectrum Scale. Both products Spectrum Archive Enterprise Edition and Spectrum Protect for Space Management can be recommended. Each product has it‘s own strengths.

* HSM refers to the capability to migrate files from disk to tape transparently

Funkcionális összehasonlítás – Backend Storage System And Platforms

Category	Spectrum Protect for Space Management	Spectrum Archive Enterprise Edition
Backend Storage Type	Backend storage provided from Spectrum Protect server with wide range of storage medium types supported (Disk, Tape, Optical, Object)	IBM Tape drives and libraries
Backend Storage Data Format	Data is stored in proprietary format. Tape cartridges containing data can be used only in combination with Spectrum Protect server	Data is stored in open LTFS format. Single cartridges can be used directly with Spectrum Archive SE or LE and vice versa (export and import function)
Supported Tape Systems	Multi-vendor support, including LTO, IBM TS1100, Oracle StorageTek, DLT and virtual tape libraries.	IBM LTO and TS1100 tape drives with IBM TS3500, TS4500 and TS3310 libraries
Tape library sharing	Yes, multiple TSM servers can share the same tape libraries and tape drives, but not tape cartridges.	All Spectrum Archive nodes share 1 tape library and all tape cartridges. Each node requires dedicated drives. (IBM plans to support sharing of 2 tape libraries in 4Q15).
Backend Storage Device Collocation	Data can be collocated on filespace level to implement dedicated storage volume usage	Can be collocated on file system, directory and file name level
Backend Storage Metadata	Spectrum Protect servers uses DB2 instances for metadata	Metadata stored on tape cartridge and file system (Spectrum Scale)
Platforms	See slide: „Highlevel Architecture“	

Funkcionális összehasonlítás – Data Transfer And Scalability

Function	Spectrum Protect for Space Management	Spectrum Archive Enterprise Edition
File Migration	• Premigration and Migration of multiple (small) files in one transaction. • Tape optimized migration (Bulk recall)	• Premigration and Migration of multiple (small) files in one transaction • Tape optimized migration (Bulk recall)
File Recall	• Normal recall (full file) • Tape optimized recall (Bulk recall) • Cluster wide recall distribution • Streaming recall • Partial recall	• Normal recall (full file) • Tape optimized recall • Cluster wide recall distribution • Tape optimized transparent recall
Scaling migrate and recall throughput	• Add Space Management nodes • Add Spectrum Protect servers • Add tape resources	• Add Spectrum Archive EE nodes • Add tape resources
Linear scalability	Limited by number of Spectrum Protect server and LAN connections to Spectrum Protect server	By adding tape drives and Spectrum Archive EE nodes

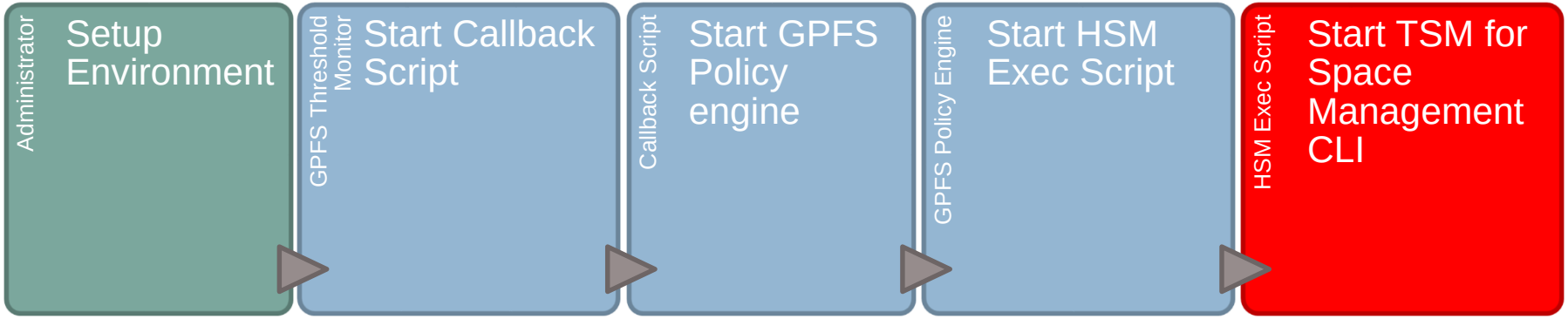
Funkcionális összehasonlítás – Protection And DR

Function	Spectrum Protect for Space Management	Spectrum Archive Enterprise Edition
File system backup	Close integration with Spectrum Protect backup archive client (mmbackup)	No support for file system backup
Creating multiple copies	Using copy storage pools in Spectrum Protect Server. Node replication feature of Spectrum Protect server.	By migrating data to more than one tape cartridge pools (up to 3 copies)
Preservation of attributes	POSIX attributes and full ACL / EA support are preserved in Spectrum Protect server	POSIX attributes are preserved on tape
Frontend Disaster Recovery (GPFS)	• Restore of files from backup (when available) • Recreation of deleted stub files • Recovery of full file system with SOBAR	Recreation (rebuild) of deleted stub files, requires to read all tapes
Backend Disaster Recovery (TSM or LTFS Tapes)	DB2 is central metadata storage and can be restored from backup and use copy pools to recover from volume failues. Switch to replication node of Spectrum Protect server.	Content of damaged tapes can be repaired if multiple copies have been created during migration.
High Availability	• Automated failover of HSM service in terms of node failure in a multi-node cluster • Automated recovery of local HSM service in terms of processing failures	Manual failover of Spectrum Archive EE services in a multi-node cluster

Policy Based Threshold Migration – Components and Responsibilities

Administrator (Action required: Once)	• Defines Spectrum Scale policy rules • Defines migration callback script • Defines HSM exec script • Enables Spectrum Scale threshold callback
Spectrum Scale (Action required: Continuously)	• Monitors file system thresholds • Starts threshold callback function • Scans file system directory and inode structure • Generates candidates lists for migration • Starts HSM migration commands
Spectrum Protect for Space Management (Action required: Continuously)	• Performs premigration of files • Performs migration (stubbing) of files

Policy Based Threshold Migration - Workflow



- Policy rules sample: `/usr/lpp/mmfs/samples/ilm/mmpolicyRules-lowspace.sample`
- Callback script sample: `/usr/lpp/mmfs/bin/mmstartpolicy`
  - Number of used migrate processes can defined here (Option -m)
  - Number of objects per migration file list can be defined here (Option -B)
  - Callback runs on the GPFS file system manager node. Ensure HSM is installed on all manager nodes. See command: `mmlsmgr`
- HSM exec script sample: `/usr/lpp/mmfs/samples/ilm/mmpolicyExec-hsm.sample`
- Tivoli Field Guide “TSM for Space Management – GPFS Integration” describes base configuration
- GPFS Advanced Administration Guide describes the policy language

TSM = IBM Spectrum Protect | GPFS = IBM Spectrum Scale

Spectrum Scale (ESS) mint Storage Pool

Miért éppen ESS?

A három legfontosabb kérdés minden mentőeszköz esetén:

1. Befejeződik –e a mentési ablakban a mentés (RPO)?
2. Visszatölti –e a rendszer az adatokat a kívánt idő alatt (RTO)?
3. A mentett adatok tárolása mennyire megbízható?

1. - 2. Kérdésre a válasz
   Elastic Storage Server(ESS) is built on Spectrum Scale which allows for **parallel writes and reads** of data blocks with high I/O rate (MBps)

3. Kérdésre a válasz
   Elastic Storage Server(ESS) has declustered Spectrum Scaler RAID protection with **2 and 3 fault tolerant erasure codes** and end-to-end checksum to provide data integrity

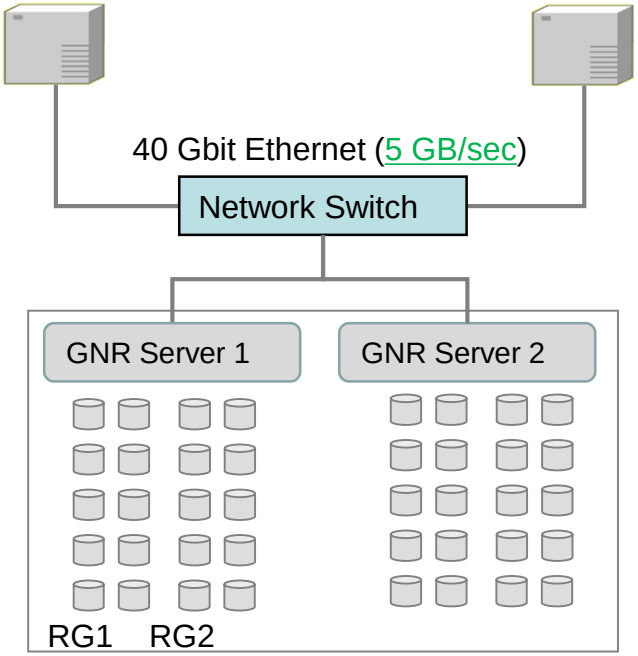
Három tesztsorozat (Proof of Concepts) / TSM storage pool ESS -sel

1. TSM and GNR system (equivalent to ESS GL6) using 56 Gbit Infiniband connection
   (June / July 2014)
   - Focus Area:
     - Interoperability
     - TSM server options
2. TSM and GNR system (equivalent to ESS GL2) using 40 Gbit Ethernet connection
   (November / December 2014)
   - Focus Area:
     - Ethernet connection
     - Concurrent Workload (Read/Write)
3. TSM and GNR system (equivalent to ESS GL2) using 10 Gbit Ethernet connection
   (December 2014 / January 2015)
   - Focus Area:
     - 10 Gbit Ethernet connection

GNR = GPFS Native RAID
ESS = Elastic Storage Server

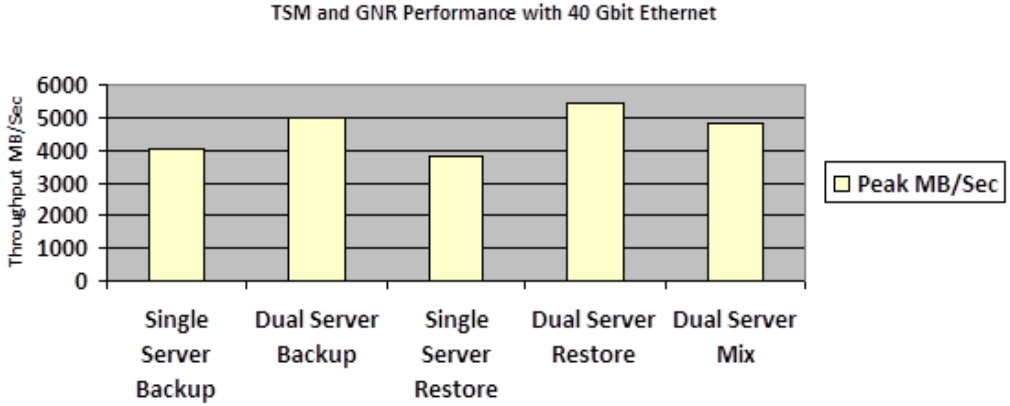
Test Environment: “40 Gbit Ethernet connection”

TSM 7.1.1.100 Servers and clients
Two standard x86 servers
Red Hat Enterprise Linux Server 6.5



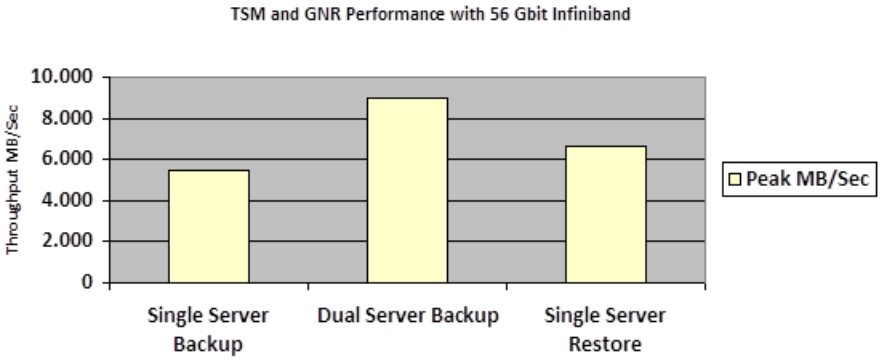
Peak Performance:

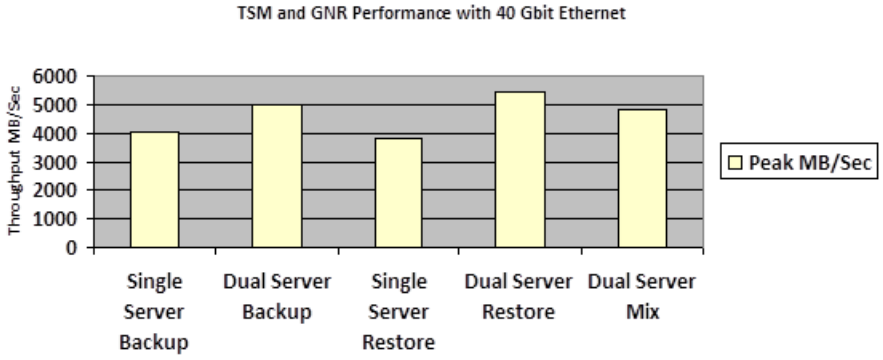
- Single TSM server BACKUP with multiple sessions 4.017 MB/sec
- Dual TSM server BACKUP with multiple sessions 4.981 MB/sec
- Single TSM server RESTORE with multiple sessions 3.834 MB/sec
- Dual TSM server RESTORE with multiple sessions 5.424 MB/sec
- Dual TSM server MIXED with multiple sessions 4.821 MB/sec



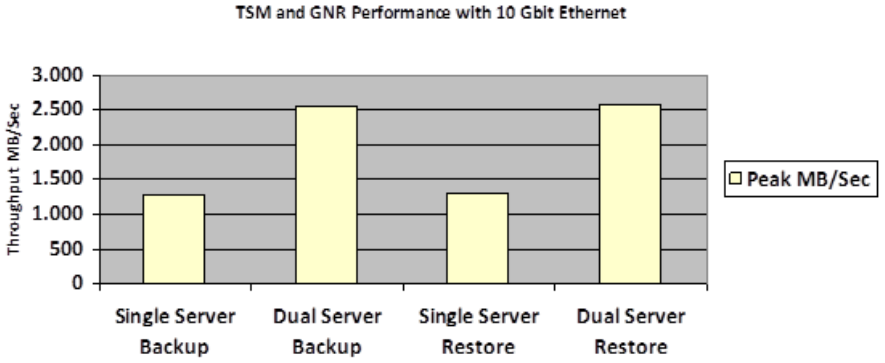
GPFS Native RAID system with 116 NL-SAS disk
Equivalent to Elastic Storage Server GL2 with est. GB/sec: 5+

Test Summary





- Performance scales almost linear
  - Network bandwidth is a limiting factor
- Ease of Use
  - Just setup a single file system
- Superior performance for
  - Single Session and Multiple Sessions
  - READ and WRITE
    - Nearly no difference between read and write performance numbers



IBM Elastic Storage Server (ESS)

Integrated scale out data management for file and object data

- ***Delivers Extreme Data Integrity***
  - *2- and 3-fault-tolerant erasure codes*
  - *End-to-end checksum*
  - *Protection against lost writes*
  - *Fastest rebuild times using Declustered RAID*
- ***Breakthrough Performance***
  - *Declustered RAID reduces app load during rebuilds*
    - *Up to 3x lower overhead to applications*
  - *Built-in SSDs and NVRAM for write performance*
  - *Faster than alternatives today – and tomorrow!*
- ***Lowers TCO***
  - *3 Years Maintenance and Support*
  - *General Purpose Servers*
  - *Off-the-shelf SBODs*
  - *Standardized in-band SES management*
  - *Standard Linux*
  - *Modular Upgrades*

ESS család

- Skálázható kapacitás és teljesítmény, valódi SDS
  - nincs hagyományos storage kontroller
  - Mix ESS, disk, Flash, SSD, 3rd party storage stb.

  - GL = High Capacity
    - Analytics, Cloud Serving, Technical, Media
    - 60 disk drawers: 2TB, 4TB disks

  - GS = High IOPS
    - Hot data and/or Metadata
    - 24 slot disk/SSD drawers: SSD (400/800), SAS 1.2TB

- Kapcsolódás: 10GbE, 40 GbE, Infiniband

Model GL2
Analytics Focused
2 Enclosures, 12U
116 NL-SAS, 2 SSD
5+ GB/Sec

Model GL4
Analytics and Cloud
4 Enclosures, 20U
232 NL-SAS, 2 SSD
10+ GB/Sec

Model GL6
PetaScale Storage
6 Enclosures, 28U
348 NL-SAS, 2 SSD
12+ GB/sec

Model GS1
24 SSD
6 GB/Sec

Model GS2
46 SAS + 2 SSD or
48 SSD Drives
2 GB/Sec SAS
12 GB/Sec SSD

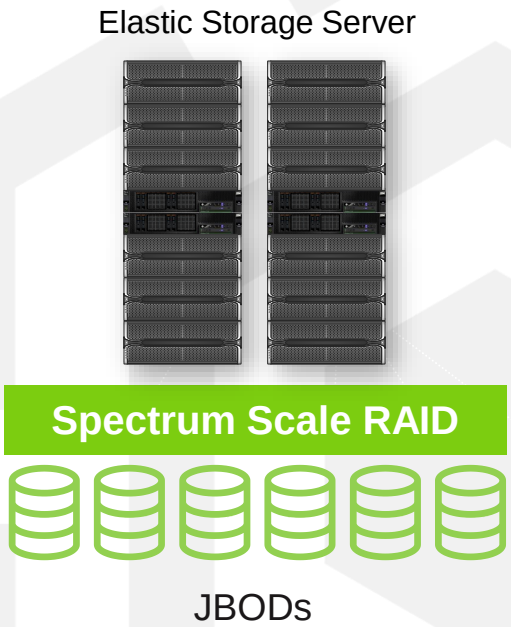
Model GS4
94 SAS + 2 SSD or
96 SSD Drives
5 GB/Sec SAS
16 GB/Sec SSD

Model GS6
142 SAS + 2 SSD

7 GB/Sec

Advantages of Spectrum Scale RAID

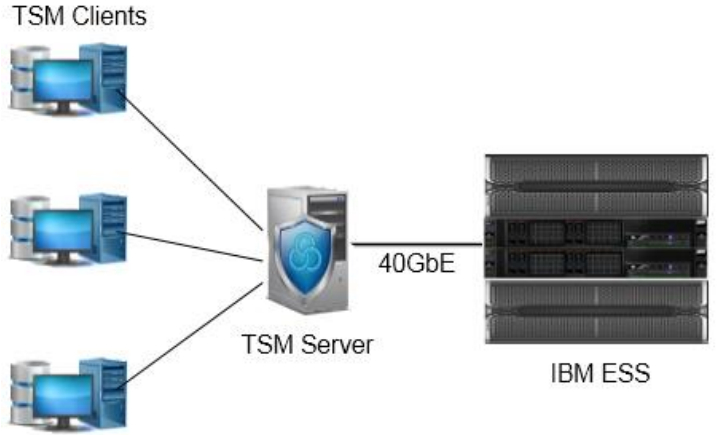
- **Use of standard and inexpensive disk drives**
  - Erasure Code software implemented in Spectrum Scale
- **Faster rebuild times**
  - More disks are involved during rebuild
  - Approx. 3.5 times faster than RAID-5
- **Minimal impact of rebuild on system performance**
  - Rebuild is done by many disks
  - Rebuilds can be deferred with sufficient protection
- **Better fault tolerance**
  - End to end checksum
  - Much higher mean-time-to-data-loss (MTTDL)
    - 8+2P: ~ 200 Years
    - 8+3P: ~ 200 Million Years



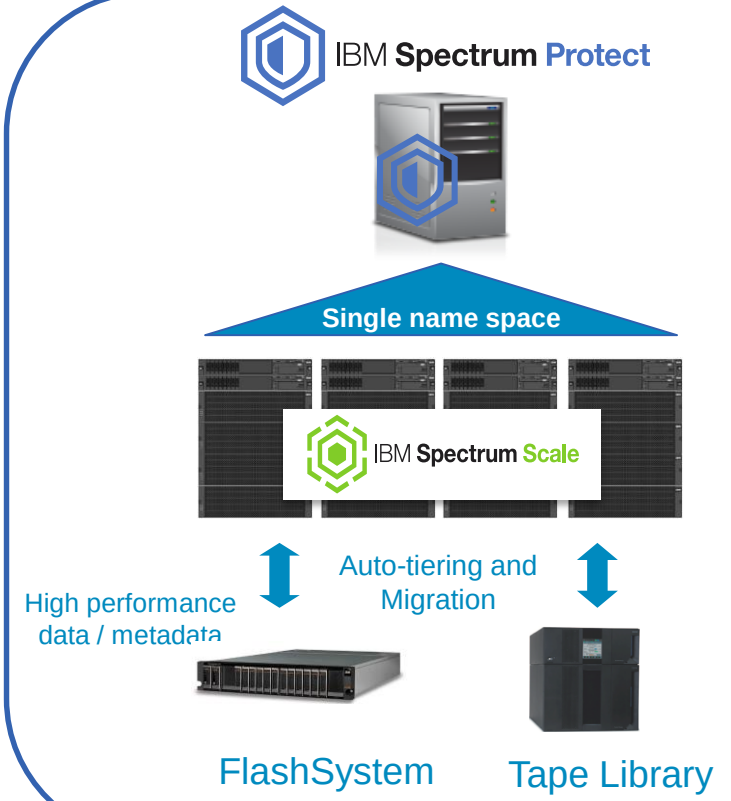
TSM Blueprint: TSM with Elastic Storage Server GL2 available!

- Support for IBM Elastic Storage Server (ESS)
  - Configuration instructions for large TSM server with ESS GL-2
  - Configuration script support for automating TSM server setup with ESS
  - Initially published for Linux x86_64

- Check https://ibm.biz/TivoliStorageManagerBlueprints for availability of the TSM Blueprint



Spectrum Scale mint Spectrum Protect Storage Pool

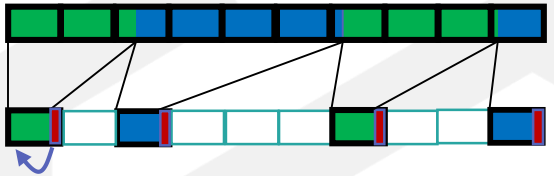


- Low cost, high performance storage for backup data
- 6-7x faster than Isilon storage based on similar benchmarks http://www.theregister.co.uk/2014/08/12/mirror_mirror_on_the_wall_who_has_the_best_tsm_backend_of_all/
- Deduplicated data using Spectrum Protect software defined deduplication
- Spectrum Protect Blueprint for ease of deployment of combined solution https://www.ibm.com/developerworks/community/wikis/home?lang=en#!/wiki/Tivoli%20Storage%20Manager/page/IBM%20Spectrum%20Protect%20Blueprints
- At one customer, we have shown over 14GiB/s performance with a single Spectrum Scale filesystem used by 2 Spectrum Protect servers and multiple storage agents

Újdonságok 4.2 –es Spectrum Scale -ben

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



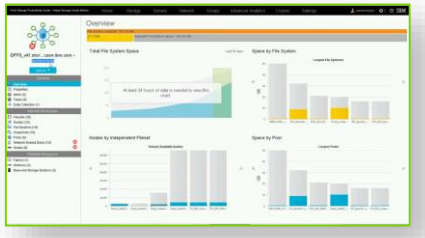
Vision

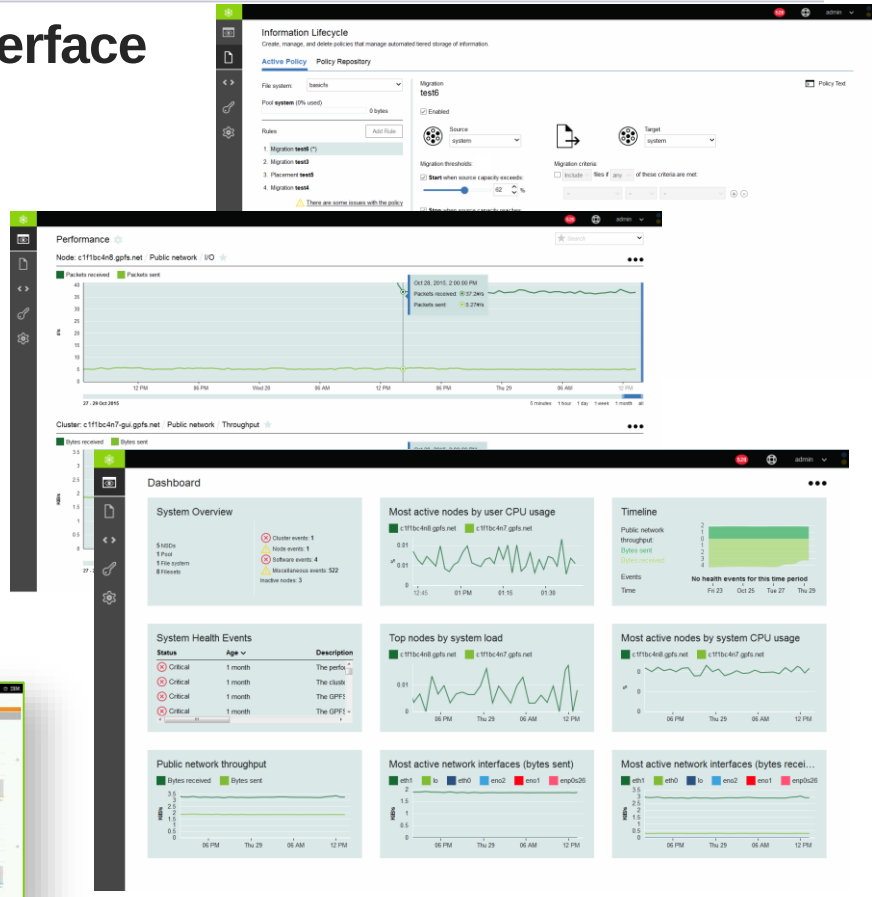
- *Which files to compress*
- *When to compress the file data*
- *How to compress the file data*

Speed and Simplicity: Graphical User Interface

- **Reduce administration overhead**
  - Graphical User Interface for common tasks
- **Easy to adopt**
  - Base interface on common IBM Storage Framework
- **Integrated into Spectrum Control**
  - Storage portfolio visibility
    - Consolidated management
    - Multiple clusters

IBM Spectrum Control





New in Spectrum Scale 4.2

	New Feature	Benefit
Client Experience Focus	•Common interface across Spectrum Portfolio •GUI Phase 1	Easy to learn UI and integration across Spectrum Storage portfolio Simplify common management functions, including •Enabling protocols •Policy driven placement and ILM •Monitoring •Troubleshooting
Object Storage	•Unified File and Object •Extended S3 API support	Single view of data with wither file or object read and write Enable applications originally written for AWS
Big Data & Analytics	•Native Hadoop Support •Ambari Integration	Higher performance and broader integration with HDFS applications to go beyond Hadoop and embrace Map/ Reduce ecosystem
General	•Quality of Service for File •Compression for File and Object •z Linux Asynch DR and Backup	Expanding functionality in Spectrum Scale data aware policy engine: •Performance reservations to meet SLAs – even by time of day •Efficiently reduce data size by up to 50% based upon business or technical policy •Extending multi-site resiliency features to z-Linux
Spectrum Scale RAID	•Expanding erasure code support on Elastic Storage Server	Higher resiliency and faster rebuild times for Elastic Storage Server

Spectrum Scale virtual machine

IBM Spectrum Scale VM based Open Beta

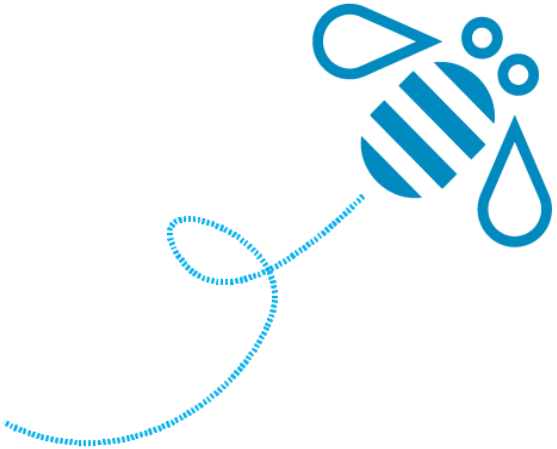
This Open Beta offers fully pre-configured IBM Spectrum Scale instance in a virtual machine as an early preview of our upcoming IBM Spectrum Scale release. The download bundle includes the virtual image and the requisite guides (Quick Start guide, Explore guide and Advanced guide) allowing you to try the key upcoming features in minutes. 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
3 Nov 2015	Open Beta	VM with pre-configured IBM Spectrum Scale	Download

Kérdések?

Köszönöm!



Back up material

Technical Features v4.2

	Express Edition	Standard Edition	Advanced Edition
Support for maximum file system size, number of files, file systems and number of nodes	✓	✓	✓
Node roles: Collector node, Admin node	Free	Free	Free
Node roles: Cluster Config Server, Manager, quorum, tie-breaker, NSD server	✓	✓	✓
Multi-cluster	✓	✓	✓
Quotas (user and group only)	✓	✓	✓
Snapshots	✓ (file system)	✓ (file set)	✓ (file set)
Management GUI		✓	✓
Compression (2:1 to 5:1 ratio)	✓	✓	✓
Quality of Service	✓	✓	✓
Filesets		✓	✓
Multi Protocol access		✓	✓
Storage Pools		✓	✓
ILM Placement and Management policies		✓	✓
HSM with TSM or LTFS		✓	✓
MC Store cloud gateway [Tech Preview only]			✓
AFM caching and Asynchronous DR (gateway nodes)			✓
Encryption of data at rest and secure erase			✓

IBM Spectrum Scale Value

Storage management at scale

- New GUI & health monitoring
- Unified File, Object & HDFS
- Distributed metadata & high-speed scanning
- QoS management
- 1 Billion files & yottabytes
- Multi-cluster management with Spectrum Control

Store everywhere. Run anywhere.

- Advanced routing with latency awareness
- Read or Write Caching
- Active File Management for WAN deployments
- File Placement Optimization
- End-to-end data integrity
- Snapshots
- Sync or Async DR

Improve data economics

- Tier seamlessly
- Incorporate and share flash
- Policy driven compression
- Data protection with erasure code and replication
- Native Encryption and Secure Erase compliance
- Leading performance for Backup and Archive

Software Defined Open Platform

- Heterogeneous commodity storage
- Software, appliance or Cloud
- Data driven migration to practically any target
- OpenStack SWIFT and S3
- Transparent native HDFS
- Integration with Cloud

Comparison of GPFS backup methods

Characteristic	Snapshot	mmbackup	SOBAR
RTO	Low	High	Medium
RPO	Low	Medium - High	Medium
Backup window	Low	High	Medium
Versioning	Yes (multiple Snapshots)	Yes	No
Disaster protected	No	Yes	Yes
Complete restore	Yes	Maybe	Yes
Backup to tape	No	Yes	Yes
Integration with ILM	No	Yes	Yes